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Implementing Nonpoint Source Pollution Controls at Marinas: A Rhode Island Experience

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Implementing Nonpoint Source Pollution Controls at Marinas:

A Rhode Island Experience

By

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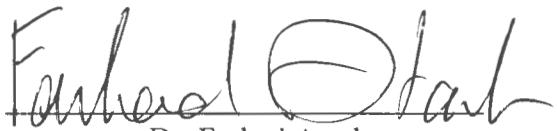
Approved By:

Major Professor



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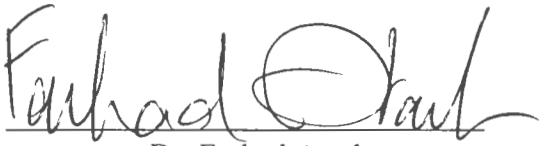

Dr. Farhad Atash

ACKNOWLEDGMENTS

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In addition I would like to acknowledge Dr. Farhad Atash (my major professor) and Dr. Howard Foster (one of the projects readers) of the University Department of Community Planning and Area Development for their commitment and contribution to the project. Although they did not advise me on this specific project, this work also reflects past interactions with several other faculty members within this department. In particular, past courses with Kevin Flynn, Dave Westcott Marshall Feldman, and Marcia Marker Feld have helped me formulate an approach to problem setting and solving through planning in an environmental, political, social, moral and economic context. Lastly, I would like to thank my family and friends for their continual encouragement and support. Without them I am sure that I could have never accomplished what I have. Thank you.

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INTRODUCTION

Background

In 1990 Section 6217 (g) of the Coastal Zone Act Reauthorization Amendments (CZARA) required that by 1999 all states with an approved Coastal Resources Management Program develop and implement Best Management Practices (BMPs) for controlling nonpoint sources of pollution at marinas. In addressing this requirement through the development of the States *Environmental Guide for Marinas* and subsequent Marina Operation and Maintenance Program for controlling nonpoint source pollution, it then became evident to coastal regulators and industry representatives that although the current literature provided comprehensive BMP descriptions and varying policy frameworks for compliance with CZARA; there still existed a lack in hands-on-experience regarding actual implementation strategies and the overall effectiveness of individual BMPs.

After developing the *Environmental Guide for Marinas* in cooperation with the Rhode Island Marine Trades Association, Coastal Resources Management Council and the Rhode Island Department of Environmental Management Office of Environmental Coordination, the University of Rhode Island Coastal Resources Center/Rhode Island Sea Grant Marine Advisory Service (CRC/RI Sea Grant) entered into a cooperative agreement with the Narragansett Bay Estuary Program (NBEP) to implement and evaluate BMPs for controlling nonpoint sources of pollution at marinas. In March of 1995, CRC/RI Sea Grant then officially began this implementation and evaluation effort by enlisting the author, a Graduate Student from the University of Rhode Island Department of

Community Planning and Area Development (CPAD), to usher the project through the tasks outlined below.

Project Overview

Selection of Participating Marinas

The first project task involved soliciting five marinas to serve as laboratories for the ground truthing of the states new policy and for the actual implementation and evaluation of BMPs. The original list of potential participants was generated by the Rhode Island Marine Trades Association and was then condensed to provide minimal overlap and diversity in facility size, type of ownership, services provided, and perceptions toward nonpoint source pollution control. In the end, seven different marinas were solicited with the final five being those who agreed to participate. A summary of the key characteristics for the final participants is presented in Table 1.

Table 1. - Key Characteristics of Participating Marinas

Marina	Size (# of berths)	Services Provided	Ownership
One	248	2	Private
Two	256	3	Corporate
Three	380	1	Private
Four	161	1	Private
Five	85	2	Private

***Note:** 1 = hauling and storage; 2 = minor mechanical and finishing procedures along with the activities of category of 1; and 3 =. categories 1 and 2 plus major mechanical, finishing, and structural repairs.
Source: Operation and Maintenance Plans as submitted to RI CRMC, 7/96.

Identifying Priority BMPs

With the participating marinas selected, the project then turned to identify the priority BMPs for implementation at the individual facilities. Accomplished using the process fostered by the State's *Environmental Guide for Marinas*, all BMPs originally

checked by the participating marina operators as "planned for implementation" were initially considered for use. These were then prioritized according to the needs of the participants and the ability of the project's budget to support their needs. As depicted by Table 2, the BMPs finally selected for implementation generally fell into three categories.

Table 2. - BMPs Selected for Implementation by Participating Marina

BMP	Solid Waste Effort	Liquid Waste Effort	Educational Efforts
Using Vacuum Sanders	2,4,5		
Recycling-glass, tin & plastic	1,2		
Secondary Containment		1,3,5	
Separate Collection Facilities		1,5	
Spill Response Equipment		4	
Spill Response Plans		2,4	
Conducting Workshops			All
Distributing Literature			All
Posting Signs			2,3,4,5

Note: numbers correspond to the marina at which the practice was implemented.

Developing BMP Implementation Plans

Once the selected BMPs were finalized, plans were then developed that detailed how the BMPs would be implemented and evaluated at each marina. These plans described the individual practices, the needed equipment, costs and suppliers; strategies applicable for implementation and evaluation; and finally, a schedule for completing the process detailed (see the following section for more information on developing implementation plans).

Implementing BMPs

During the implementation phase, the author worked with the participating marina operators and NBEP to purchase the necessary equipment; address operational and regulatory problems; ensure that the equipment was properly installed and operating; and

to monitor and evaluate the patterns of BMP use at the five participating marinas.

Evaluating BMPs

With the implementation and monitoring of the selected BMPs completed, project tasks then shifted to focus on the actual evaluation. The criteria used for evaluating BMPs included their installation cost, use rates, amount of pollutants collected, or measured changes in boater behavior when regarding educational efforts. The primary data used in this evaluation was collected in the three following manners: through the use of log books, purchase invoices and the conducting of a boater survey (see section three for more information on monitoring and evaluation techniques).

Transferring the Experience

The final tasks in completing the project involved facilitating the transfer of the experiences gained to both local and national audiences of marina operators and coastal regulators. In accomplishing this, the following two documents have been developed:

Document 1 (Abating Nonpoint Pollution at Recreational Boating Facilities: Applying Innovative Best Management) - Written as a technical report to the project's funders, document 1 contains such elements as detailed project methodologies, final BMP implementation plans, complete project findings and survey results, and all other project impacts and outputs.

Document 2 (Implementing Nonpoint Pollution Controls at Marinas: A Rhode Island Experience) - Submitted as the author's Master's Research Project, ***this document*** has been written as a planning and implementation guide for both coastal regulators and industry representatives contemplating the selection and use of nonpoint source pollution controls for marinas. Building upon the original technical report, this document focuses

on the experiences gained, lessons learned, recommendations generated, and tools developed throughout the entire BMP selection, implementation and evaluation process.

Document Purpose

In short, it is felt that transferring these experiences will help to fill the current gap in the literature by providing previously unavailable information on which to base decisions regarding BMP prioritization, selection, and implementation. Keeping the above in mind, the specific purpose of this document is then to serve as a concise planning supplement to the many descriptive BMP manuals already in existence. It is hoped that the provision of this knowledge will result in more effective and efficient BMP implementation at both the state and industry level with the ultimate outcome being greater potential reductions in nonpoint sources of pollution and improved water quality.

Organization

In fulfilling its purpose, the remainder of this document has been organized into four major sections and a set of useful appendices. Following this introduction, the second section traces the project back to its beginning in that it explains the methods used and knowledge gained during the BMP prioritization, selection and planning phases. From this point section three carries forward with a detailed discussion on the importance of, and techniques available for, BMP monitoring and evaluation. With the stage set, section four then presents the final evaluations or case studies produced for each of the BMPs implemented and evaluated at the five participating marinas. The proceeding fifth and final section then concludes with summary observations and final recommendations.

A group of selected appendices including example BMP implementation plans, sample surveys, workshop session plans/publicity materials, and educational materials complete the report by illustrating various points made within the document.

INITIAL PREPERATIONS FOR BEST MANAGEMENT PRACTICE IMPLEMENTATION

This section discusses the importance of, and presents strategies for, characterizing the target audience for BMP implementation; identifying priority BMPs for consideration; and developing implementation plans. In recognizing that the methods presented are not the only potential options available in all instances; attempts will be made to point out other useful strategies when appropriate.

Characterizing the Audience

In any attempt to implement BMPs it becomes helpful to first have an understanding of the target audience's basic demographics and general characteristics such as their age, gender, income and perceptions toward nonpoint source pollution controls. Having such information available can often help in designing and constructing effective implementation strategies. In the most general instance the target audience will include the marina's customers plus the staff. Seeing as how marina operators generally have closer relationships with, established instructional procedures for, and tighter supervision over their staff; this discussion focuses on the actual customers, a group of people who often are harder to characterize, reach, and therefore influence.

How To

If basic demographics and general characteristics of marina customers are not available for a specific region, perhaps the easiest way to generate data is to solicit it from the customers themselves. Although the information presented below was generated using such an approach; it is important to point out two considerations specific to

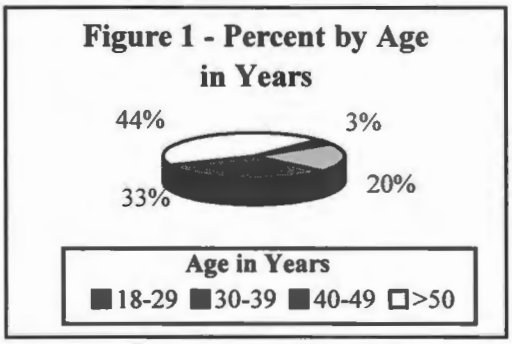
gathering such background information, prior to referring the reader to section three for detailed discussions on the survey approach. These considerations are as follows: 1) this type of information will prove useful only if acquired prior to the development of implementation plans, not after; and, 2) rather then administering a separate survey, consider acquiring this information through the distribution of seasonal storage contracts. To do this, simply include the types of questions contained in Appendix A, Sample Survey/Background Information and Miscellaneous Questions in seasonal storage contracts and then tally the results as they come back in. Refer to the following section for further details regarding the use of surveys.

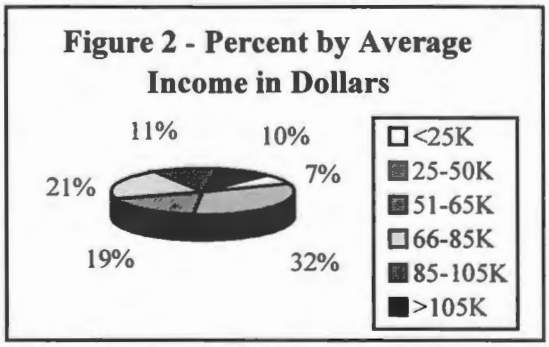
Project Findings

In using the survey technique, this project has generated a variety of statistics and identified several relationships helpful in characterizing the Rhode Island marina customer base. With 380 questionnaires distributed by mail in June of 1996 and with an overall response rate of 21.3%, the survey results include demographics such as: percent respondents by gender, age and average annual household income; plus years spent boating; and other indicators such as boater willingness to invest in a cleaner boating environment. Detailed survey highlights follow, but please note that complete survey results and methodologies are available in NBP final project report *titled Abating Nonpoint Pollution at Marinas*.

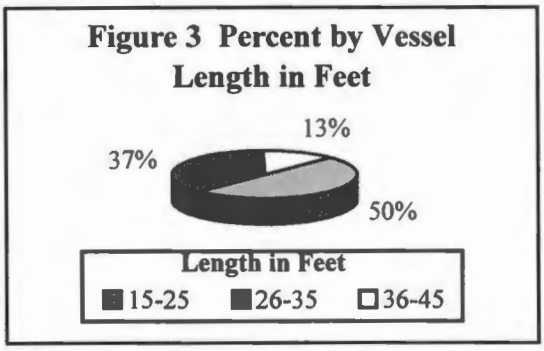
- 94% of the respondents were male with the overall percentage breakdown by age being: 44% 50 years and older; 33% between 49 and 40 years; and the remanding 23% being 39 years or younger (see Figure 1).

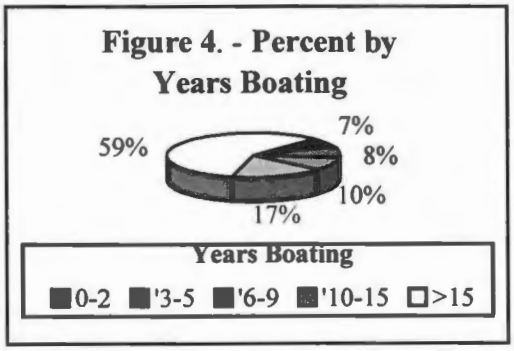
- 16% of the respondents were retired with the percentage breakdown by annual household income being: 21% earning greater than $85,000; 40 % earning between $85,000 and 51,000; 32% earning between $50,000 and $25,000; with the remaining 7% earning less than $25,000 (see Figure 2).



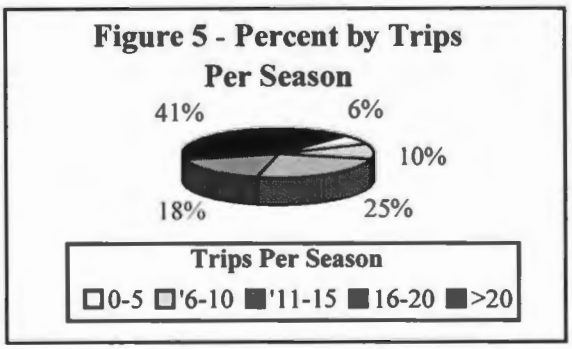


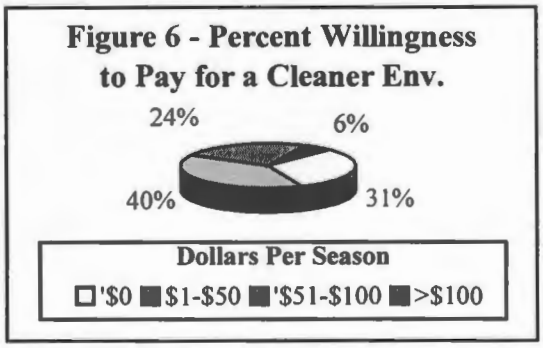
- 60% of the respondents owned powerboats with the percentage breakdown by vessel length in feet being: 13% equal to or greater than 36 feet in length; 37% being between 26 and 35 feet in length; and the remaining 50 % being between 15 and 25 feet in length (see Figure 3).
- 59% of the respondents have been boating for more than 15 years. An additional 27% have been boating between 14 and six years and the remaining 15% have just started boating within the past 5 years (see Figure 4).
- 59% of the respondents make 16 or more trips per season. Another 25% make between 11 and 15 trips per season, 10% make between 6 and 10 trips per season, and the remaining 6% make 5 or less trips per season (see Figure 5).





- 67% of the overall respondents used BMPs but no significant relationships between BMP use and respondent gender, age, annual household income, occupation, vessel type, vessel length, years boating and trips per season were identifiable.
- Overall, 31% of the respondents were not willing to pay for a cleaner boating environment; but, 40% were willing to pay between $1 and $50, 24% were willing to pay between $51 and $100, and only 6% were willing to pay more than $100 (see Figure 6).

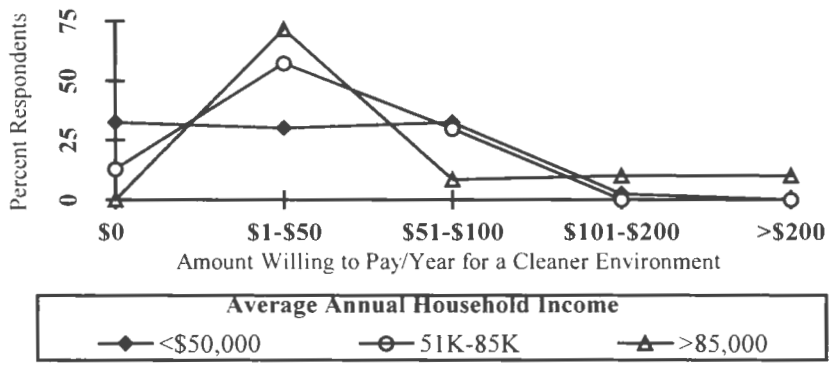




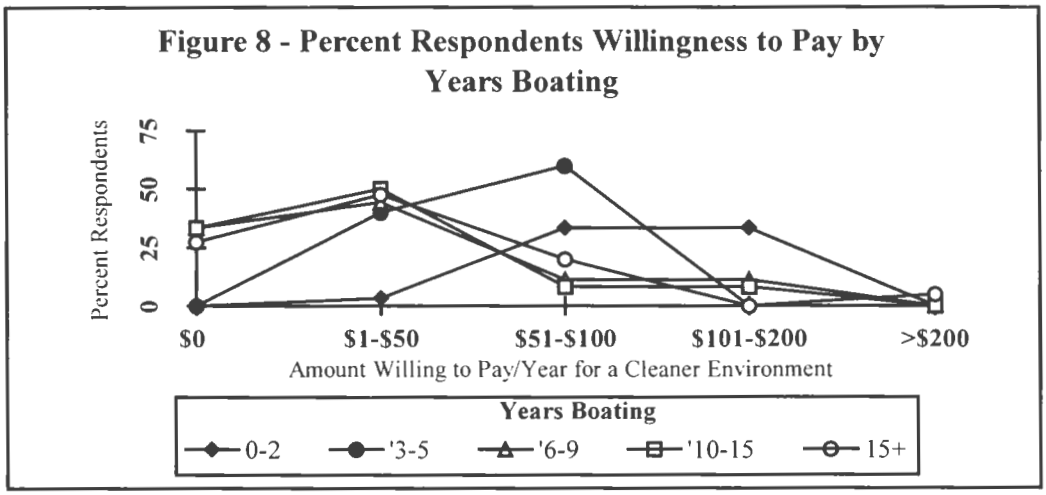
- When cross compared, respondent gender, occupation, vessel type, and trips per season appeared to have no relationship with the respondents willingness to pay for a cleaner environment. On the other hand, respondent age in years, average annual household income, years boating and length of vessel did; and these relationships can be summarized as follows:

1. *"Those who make more are more willing to pay for a cleaner boating environment"* - Although those who earn more than $85,000 per year are the least willing to pay between $51 and $100; they are the most willing to pay between $1 and $50, the most likely to be willing to pay upwards of $100, and least likely not to be willing to pay at all. Also, those who earn less then $50,000 per year are the most likely not to be willing to pay at all, the least likely to be willing to pay between $1 and $50, and one of the least likely willing to pay upwards of $100 (see Figure 7).

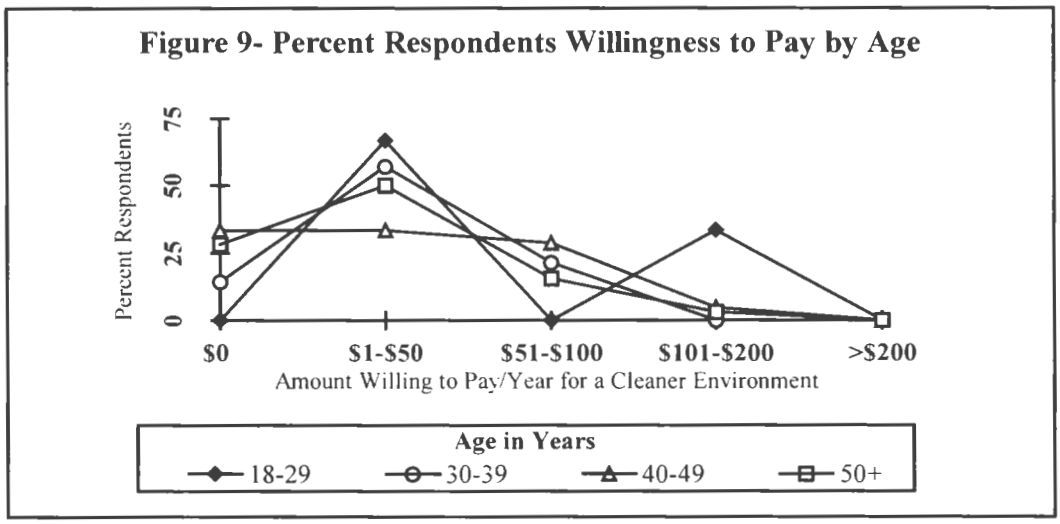
Figure 7 - Percent Respondents Willingness to Pay by Income



2. *"Those who have been boating longer are less willing to pay for a cleaner boating environment"* - Those who have been boating for more than 6 years are most likely not willing to pay, and those who have been boating for between 3 and 5 years are willing to pay between $1 and $50 but are not willing to pay between $51 and $100; those who have been boating for less than 3 years are the least likely not to be willing to pay and the most likely to be willing to pay between $1 and $100 (see Figure 8).



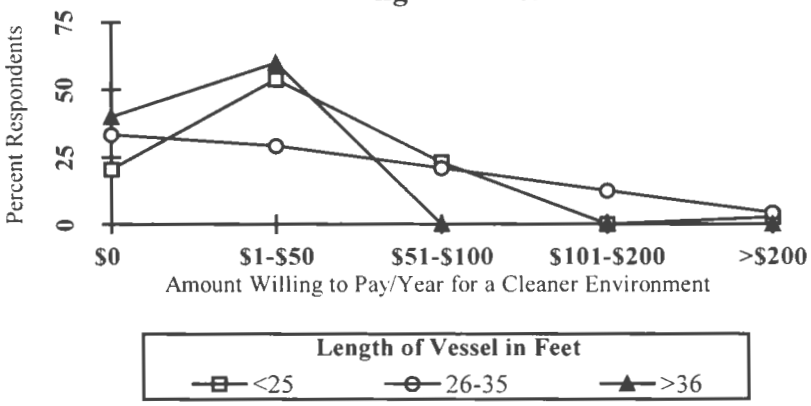
3. "*Younger respondents are most likely to be willing to pay for a cleaner boating environment*" - Although the youngest group is the least likely to be willing to spend between $51 and $100; they are the most likely to spend between $1 and $50 and upwards of $100, while also being the least likely group not to be willing to pay at all (see Figure 9).



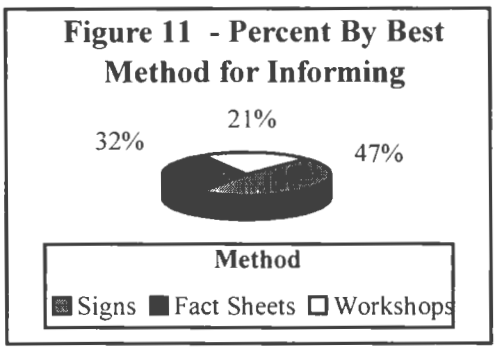
4. "*Willingness to pay for a cleaner boating environment decreases with increasing vessel size*" - Whereas the owners of the smallest vessels are the least likely to not be willing to pay for a cleaner boating environment; they are also the second most

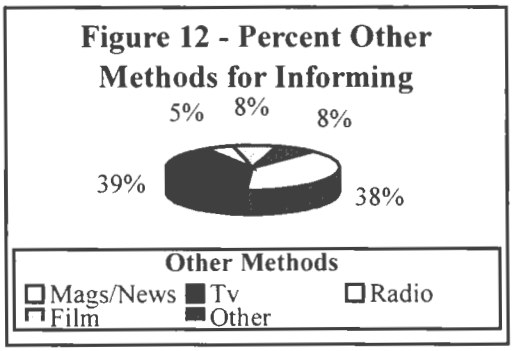
willing to pay between $1 and $50 and the most likely to be willing to pay between $51 and $100. The medium size vessel owners then round out the pack by falling below the average willing to spend less $100 and above the average willing to spend more then $200 (see Figure 10).

Figure 10- Percent Respondents Willingness to Pay by Length of Vessel



- Except to note that although 47% respondents selected signs, 32% selected fact sheets, and 21% selected workshops as their choice for best methods for informing boaters; cross comparing the methods selected with the respondent characteristics discussed above turned up no significant relationships between the various factors (see Figure 11).
- Whereas 58% respondents selected magazines and newspapers, 39% selected television, and 1.5% selected on-line computer resources as the best "other" methods for informing boaters; cross comparing the methods selected by respondent characteristics also turned up no significant relationships between the various factors(see Figure 12).





Given the previous analyses, it can be concluded that the largest percentages of marina customers in this specific geographic area are: older than 50 years; earn upwards of $85,000 per year; own medium sized vessels; have been boating for more than 15 years and prefer the posting of signs as an educational method. Using the respondents willingness to pay for a cleaner boating environment as an indicator of their larger perspective toward BMP implementation, it can be concluded that marina customers who: earn the least; are the oldest; have been boating the longest; and own the larger vessels are the least willing to participate in BMP implementation and therefore may require special attention regarding publicity and educational approaches. With a clearer characterization of the average marina customer established and those in most need of special attention identified, let us now shift to a discussion on identifying priority BMPs for implementation

Identifying Priority BMPs for Implementation

With Rhode Island's *Environmental Guide for Marinas* identifying over 50 BMPs that must be addressed by marina operators and another report (Ross, Amaral and Rhodes, 1995) identifying 150 others that may be appropriate for controlling nonpoint

source pollution, one may rightfully wonder where to begin and how to go about selecting BMPs for their own use. This section of the report provides guidance in this manner by recommending certain courses of action in the selection of BMPs for implementation.

How To

The goal of implementing BMPs is to devise a system of practices which when used meet the management measures established by CZARA 1990 and therefore effectively mitigate nonpoint sources of pollution. Recognizing this, the first step in implementing BMPs should involve the inventorying of all applicable alternatives. As mentioned above, such inventories already exist and obtaining a preexisting lists can save the marina operator considerable time. For the purposes of this project, the inventory contained in Rhode Island's *Environmental Guide for Marinas* was used; but remember, if the reader is located within another state it may be wise to check with local officials to determine if certain standards or BMPs are required and/or recommended for use in the specific jurisdiction. Regardless of the specific inventory in which the marina operator eventually works, the process described below should be effective in identifying the priority BMPs for implementation.

With a baseline list of appropriate BMPs on hand the selection process can begin. In may instances marina operators will find that they are already using a lot of the practices contained in their inventory and therefore the first task should involve categorizing these BMPs as existing and excluding them from the remainder of the selection process. The next step involves excluding those BMPs which are not applicable to the facility under consideration. For example, there is no need for a marina that does

not dispense fuel to address BMPs aimed at fueling stations. Additionally, if a given marina has a low percentage of recreational fishers and no water quality concerns have arisen due to the improper disposal of fish waste, then there is no need for that facility to address BMPs aimed at fish cleaning practices.

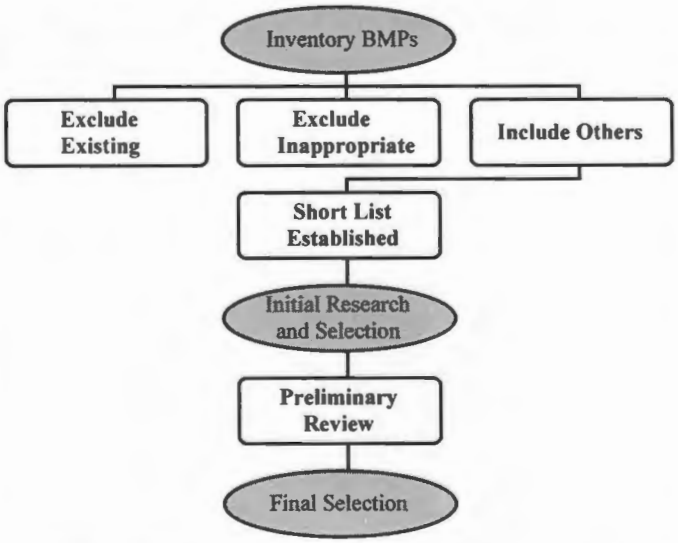
Once the existing and inappropriate BMPs have been excluded, the marina operator may then choose to include any BMPs that are not contained in the inventory but seem to present reasonable solutions to a nonpoint source pollution problem experienced at a particular site. At this point the marina operator should then be left with a "short list" of BMPs which are appropriate but are not currently in use at the given facility. Before moving on to a discussion on the final selection process I would just like to note that it can be very helpful for future regulatory compliance reviews if marina operators keep detailed notes explaining their categorization of BMPs from the inventory.

The next stage in this selection process involves doing some preliminary research on the BMPs contained in the "short list." Using sources such as this report and the others cited in the reference section, marina operators should compile applicable information for each practice including the materials needed, their estimated costs, overall effectiveness, general timetables for materials acquisition and implementation, and any state and/or local permitting needs associated with installation. Having such information on hand will then allow the cross comparison of the varying practices and the preliminary selection of BMPs to be implemented.

At this point a consultation with regulatory officials who may be responsible for reviewing the implementation efforts is advised. The goal of this meeting should be for the marina operator to present and explain the categorization of BMPs from the inventory

and to get some preliminary feedback as to whether the system of practices currently in existence and planned for implementation will meet the management measures of CZARA 6217. With a clearer understanding of the marina customers and their preferences, a preliminary knowledge of the BMPs applicable but not currently in use; and direct input and guidance from appropriate regulatory officials, the marina operator should then be able to make the final selection of the BMPs to be implemented. See Figure 13 for a depiction of this process.

Figure 13. - Priority BMP Selection Process



Project Findings

In concluding the discussion on selecting priority BMPs for implementation, the author will now briefly review the types of BMPs were consistently selected as priorities by the participating marina operators. As evident by the case studies presented in section four, fish waste, vessel cleaning, vessel sewage, and fueling station BMPs generally required less attention due to the fact that relevant nonpoint pollution sources were not widely applicable or because many of the related BMPs were already in existence. On

the other hand, educational, solid waste, and liquid waste efforts ranked high among the participating marina operators priorities. More specifically these priority BMPs included the distribution of literature, conducting of boater workshops, and the posting of signs; the use of vacuum sanders for the striping of antifouling paints and the recycling of glass, tin, and plastics; and the provision of separate collection facilities, secondary containment, and emergency spill response equipment for the disposal of liquid wastes.

Developing Implementation Plans

Once the BMPs to be used have been identified, the next task involves the development of specific installation strategies and implementation plans for each individual practice. Rather than approaching implementation in an ad-hoc fashion, taking the time up-front to develop such strategies and plans can result in: improved timing of, and transition to, new approaches; better budgeting for expense incurred; increased opportunity to monitor and evaluate the practices used; and therefore, a more efficient and effective nonpoint source pollution mitigation effort.

In any instance it can be helpful to view these documents as analogous to developing a capital improvements plan, where the marina operator is outlining what investments are to be made and what specific steps are to be taken in addressing the environmental concerns of the company over any given fiscal period. Although it is impossible to address every potential contingency in the development of these strategies, the remainder of this section will first focus on the items that should generally be included in the development of BMP implementation plans and then on some general guidelines for undertaking the planning process.

What to Include

As exemplified by the sample BMP implementation plan for the use of vacuum sanders provided in Appendix B, in the most general sense any given BMP implementation plan should at least include the following five major elements:

1. *Summary Description* - A summary description of the practice to be implemented is the first recommended element in the BMP implementation plan. Although development of such descriptions may initially seem redundant, upon experience the process has proven useful in setting the proper context and in identifying those questions which need to be addressed by the larger plan. Within this specifics such as the target audience and the nonpoint pollutant source to be controlled may be included.
2. *Materials Inventory* - The materials inventory section should list all of the foreseeable equipment and/or materials which will be needed to fully implement the practice. In developing the materials inventory be sure to be thorough in the items included. Clarify who and/or how they will be supplied as well at what costs.
3. *Implementation Process* - With the needed materials identified the plans should then focus on the actual strategy for implementation. In the most general terms this element should include step by step instructions detailing what is to be done and by whom. More specifically, special emphasis should be placed on the actual installation of the equipment, the publicity efforts that need to occur and any regulatory permitting needs.
4. *Evaluation Process* - The fourth element that should be included in implementation plans involves any strategies applicable for evaluating the effectiveness of the practice

at accomplishing its pollution control objectives. Regarding this matter the plan should detail the criteria to be considered, the method for collecting the relevant data, and a subsequent basis for analysis.

5. *Implementation Schedule* - The fifth and final element recommended in the development of BMP implementation plans involves the setting of a definite timetable or schedule in which all of the individual actions described under elements three and four are to take place.

How To

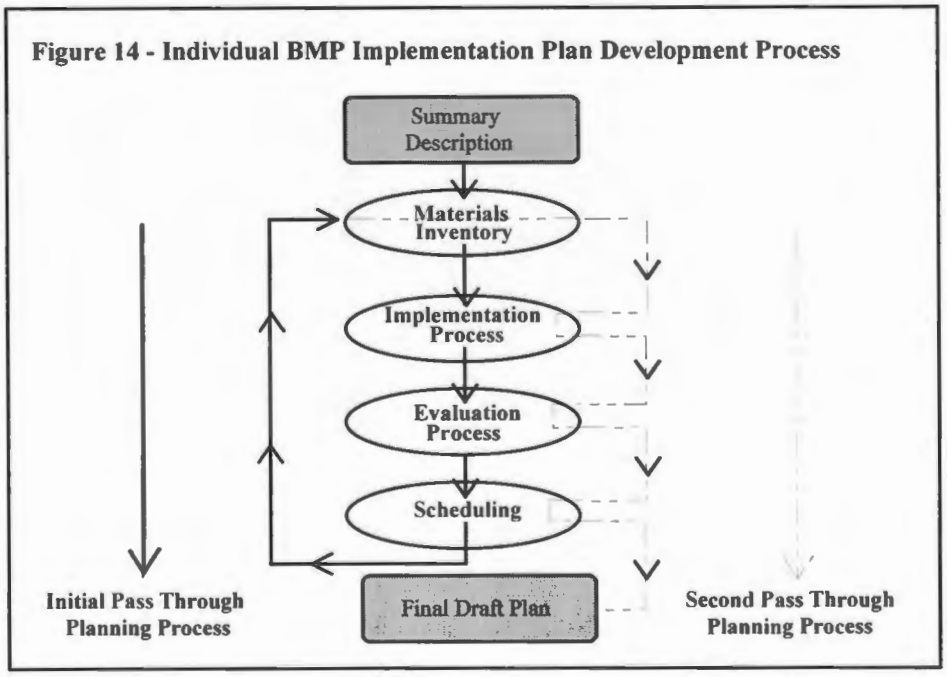
Now that the recommended content of the implementation plans has been established and a completed example referenced, we will examine a process that can be used to complete the development of the individual draft implementation plans. Starting with element number one, marina operators should find it fairly easy to summarize descriptions of the applicable practices from existing sources. Moving on, we must then recognize that identifying the needed materials, their suppliers, and their costs can be more difficult and therefore should be initially roughed out through existing equipment suppliers, state and national marine trades associations and/or other resources as identified in the reference section of this document.

With the materials inventory estimated, the next step should involve the development of the implementation and evaluation processes. Once again, in completing this task, the primary information sources will come from experiences garnished from colleagues, reports such as this and from the references contained in the back of this document (much more will be said about developing evaluation schemes in the following section). At this point, the next step in developing the individual draft implementation

plans should involve the scheduling of the tasks needed to complete the installation and evaluation. To facilitate this process efforts should be focused on those times in the season where the resources are most available, when the implementation makes the most sense and by plotting the tasks on a suitable calendar.

Having drafted the complete implementation plan, it is now recommended that marina operators return to the materials inventorying stage to double check the equipment listed and the proceeding elements of the plan. This action is highly recommended due to the fact that many unforeseen items which are initially missed in the inventorying stage are often brought to light in the development of implementation and evaluation strategies. See Figure 14 for a depiction of this process.

Figure 14 - Individual BMP Implementation Plan Development Process



Following the development of the individual draft implementation plans it is then recommended that marina operators take the time to analyze all of the plans as a complete system with special emphasis on the scheduling of individual aspects. In doing so,

marina operators may then make final decisions, primarily based on the fiscal resources and time available, as to exactly when each of the individual plans is to be implemented. With these last decisions made, marina operators can then finalize their draft plans and begin the actual implementation strategies identified.

Project Findings

In concluding this discussion on developing BMP implementation plans it becomes difficult to generate overarching findings which relate to the development of individual strategies. Although this is true, there are several commonalties which should be re-emphasized. These commonalties are as follows: 1) the development of such plans is perhaps best visualized as analogous to the development of environmental capital improvements plans; 2) individual plans will need to be re-evaluated as the strategies to be used are refined and the larger system is scheduled for implementation as a whole; and 3) taking the time up-front to develop these plans can result in: improved timing of, and transition to, new approaches; better budgeting for expense incurred; increased opportunity to monitor and evaluate the practices used; and therefore, a more efficient and effective nonpoint source pollution mitigation effort.

DEVELOPING AN APPROACH TO MONITORING AND EVALUATION

Perhaps one of the most important and difficult tasks associated with the successful implementation of BMPs lies in developing an approach for monitoring and evaluation. Put simply, monitoring is a process designed to collect data helpful in determining the use and impact of individual practices; whereas, evaluation is the process which uses the data produced through monitoring to determine whether the practice being considered is actually effective and/or efficient.

Keeping this is mind, the purpose of this section is to discuss the primary information that should be considered, detail the approaches available for collecting information, and to recommend a course of action for the development and conducting of monitoring and evaluation efforts. In accomplishing this, the remainder of the section begins by discussing the importance and benefits produced through monitoring and evaluation; moves to a description of the criteria to be considered, presents the tools, techniques and development strategies used in this instance; and, concludes with a discussion on schedule setting and following through.

Importance and Benefits

From the individual's perspective, monitoring and evaluation produces several benefits. First and foremost is the fact that it allows individuals to determine if the time and money invested are justified by the level of pollution reduction reached. Second of all, if it has been determined that a specific practice is not producing sufficient results, monitoring and evaluation can often point to changes that can be made to the

implementation of the practice so that its overall performance can be improved. Lastly and in summary, monitoring and evaluation often results in individuals saving money, experiencing further reductions in nonpoint sources of pollution and perhaps attaining an economic and environmental edge over their competitors.

On the other hand, although individuals may gain a competitive edge by sequestering knowledge gained through BMP monitoring and evaluation, the importance of and benefits produced by sharing information far outweighs the individual gains. For example, from the industry and regulatory community's larger perspective, sharing of the results produced through monitoring and evaluation can result in: 1) a clearer understanding of BMP selection and use across the board; 2) greater reductions in the fiscal demands placed on this important economic engine and public access provider within the coastal zone; 3) improved cooperation and collaboration between industry and regulatory representatives; 4) the development of better environmental policy and compliance procedures; 5) more efficient state and national nonpoint source pollution control programs; and, 6) greater potential gains in water quality.

Criteria to Consider in Determining Effectiveness

In delving into the actual process of conducting monitoring and evaluation efforts the first question that needs to be addressed is what criteria to consider for use with any one applicable BMP. Recognizing the unlimited amounts and potential combinations of these criteria, the following discussion focuses on those that are felt to be most widely applicable and represent a baseline from which to build.

Pollutants Captured/Collected

With the goal of monitoring and evaluation being to determine a particular BMP's cost effectiveness in controlling nonpoint source pollution, perhaps the most important criteria to be considered, and one that is rather straight forward, involves the actual amounts of pollutants collected by the particular practice over a given time period. These were measured in gallons (liquid wastes), pounds (solid wastes) and volume (either solid or liquid wastes). Determining these criteria then lays the groundwork for drawing comparisons between the price paid for implementation and the pollution reductions achieved.

Cost for Implementation

Perhaps the second most important criteria to consider involves determining the overall price paid to fully implement the practice. In doing so, the determination of this criteria should not only include the initial purchase cost paid for any needed materials or equipment, but should also include all of the labor expenses associated with BMP installation and subsequent operation. For example, the cost of implementation for a piece of equipment such as the vacuum sander should not only include its purchase cost but also the time needed to develop the log books, distribute the publicity flyers, plus the time needed to manage and demonstrate its proper use.

Educational Effectiveness

With regard to educationally based BMPs, trying to determine the amount of pollutants collected as a direct result of any given activity is very difficult. Recognizing this, in these instances this project relied on an effectiveness ratio determined by comparing the numbers of people who actually learned new practices as a result of the

educational activity with those who had learned new practices but have also since begun to use them in their daily boating activities. For example in conducting and evaluating the educational BMP of distributing literature it was found that of those who learned new practices from the literature 98% of those had since begun to use the practices discussed; therefore the practice of distributing literature was 98% effective in getting boaters to use new BMPs.

Use Rates

Although the cost, pollutants collected and/or educational effectiveness of a BMP will provide the foundation for determining its overall cost effectiveness, there is a series of other criteria which can help to clarify any potentially cloudy findings produced solely from the factors presented above. Of these, the rate at which the practice is actually being used or the "use rate" is one of the first that should be considered. For example, a vacuum sander is monitored over the course of a boating season and 171 pounds of solid waste are collected. At a cost of say $1,300 dollars is this practice cost effective? It may be, or it may not. On the other hand, consider the same situation but in addition to the cost and pollutants collected, the rate at which the equipment is used has also been monitored. With this use rate on hand it can then be clarified that in collecting 171 pounds the machine was used by X number of people to sand X feet of vessel bottom with an average collection rate of X pounds of material collected per foot of vessel bottom sanded. As further exemplified in this case, use rates can take the form of many different variables. In this instance the primary variable involved the length of vessel bottom sanded in feet, but in other examples such as with the conducting of educational

workshops it may be more appropriate to consider the number of people in attendance at a given event as the use rate for that particular practice.

Level of Awareness

Another of these important clarifying criteria involves the level to which the target audience is aware of the practices existence. If the target audience is not sufficiently aware of the practice then the use rates will of course suffer as will the overall estimate of the practices costs effectiveness. Once again consider the conducting of educational workshops. Although the "use rate" may be low and the overall cost effectiveness suffers as a result, why may this be the case? Could it be due to the inherent limitations of the practice itself, or simply because the target audience was not aware of its existence in the first place. In this instance measuring the level to which the target audience new of the event or "was aware" of its existence would help to clarify the potentially cloudy findings produced by using the cost, educational effectiveness and use rates criteria alone.

User Perceptions

The final baseline criteria recommended for estimating the cost effectiveness of BMPs is the users perceptions and sentiments toward the actual practice. A somewhat more difficult criteria to classify and describe, it is very important not to overlook how the target audience views the practice. Their input, not only as to whether the practice is good or bad, but also their own ideas on improving the implementation process can often prove invaluable in correctly assessing a practices current and/or potential cost effectiveness. For example consider a liquid waste collection approach where all the marina tenants are aware of the facilities installed for their use, but over the course of a single boating season only five gallons of materials were collected. What went wrong?

The level of awareness was high and the demand solid but yet the use rates were so low. Well through soliciting comment and feedback from the users it could then be identified that perhaps the target audience was denied weekend access earlier in the season and therefore found it easier to dispose of their liquid wastes elsewhere throughout the remainder of the season. Such as exemplified here, the identifying of the users perceptions and sentiments toward a particular practice can often result in the uncovering of crucial information that can not be reached through standard criteria such as the costs of implementation, pollutants collected, educational effectiveness, use rates, and levels of awareness alone.

Tools and Techniques Available for Use

With the baseline criteria important for consideration in developing implementation and monitoring strategies presented, the focus of this section now shifts to the tools and techniques that can be used in gathering the actual data needed for evaluation. A description of the most appropriate methods, their applicable criteria and a summary of how to undertake data gathering and analysis is given for each approach. In certain cases additional examples will be given to clarify the discussion. Recognizing that the tools and techniques presented are based on the method used in this particular project, all efforts will be made to mention other appropriate approaches.

Purchase Invoices and Time Sheets

Purchase invoices are simply the receipts received upon purchasing needed equipment and materials; whereas time sheets are running lists that record the amount of person hours or labor put into development, installation or administration of the particular

practice being considered. With the purpose obviously being to determine the cost criteria associated with the implementation of a given practice, the materials that are needed outside of the actual invoices and time sheets include a separate file folder in which the records may be stored and updated.

In physically using this approach to generate information, the first thing that needs to done is to establish the file folder where the records will be kept. With the folder available to those who will be involved with implementing the practice, all that needs to be done is to place any related receipts within and to have individuals record the amount of time that they have contributed to the practices implementation.

Once the monitoring period reaches its end, the data collected within the file will then need to be compiled and analyzed. To do this simply total the person hours invested, then determine an average value or labor rate and multiply it by the person hours to get a figure in dollars for the time invested. With the time variable determined then add the amounts on the individual receipts with this variable to a get a total estimate for the complete cost paid to implement the practice.

Log Books

Perhaps one of the most useful data gathering tools, log books are documents where detailed records of a practice's use rates and pollutants collected may be recorded over a given time period. Most applicable for practices where users are dealing with tangible wastes, such as gallons of liquids or volumes of recyclable materials collected, the development of log books will usually require a detailed set of instructions for its use and a standard format for recording the applicable criteria (see Appendix C for a format example for the vacuum sander). If many individuals will be using a specific logbook, it

is recommended to purchase a quality binder in which the necessary materials can be permanently stored.

Once the actual log book has been developed its use must be publicized and instituted throughout the facility. In order to consistently gather accurate information individuals should consider either designating one person to make the entries or exercise close supervision over its use through out the monitoring period. Log books can not be developed and forgotten. There is nothing worse than assuming that the log book is being successfully used and then finding out half way through the monitoring period that people have not been using it correctly.

Having predetermined the criteria and measurements to be addressed, the analysis of the data collected through the use of log books will differ depending on the topic addressed but should be fairly straight forward in any instance. For example, through this project the volume of glass, tin and plastics properly disposed of through recycling was recorded using the log book technique. With the volume of material collected being recorded each week prior to the emptying of the containers, a total volume was first calculated and then averaged by the number of weeks that monitoring occurred to produce an average volume of material collected per week. This average was then compared with the cost to provide the service and the cost for standard disposal of the same volume to estimate the practices overall cost effectiveness in comparison to standard disposal.

Surveys

In using purchase invoices, time sheets and logbooks to generate primary data for the criteria of implementation costs, pollutants collected and in some instances use rates,

the discussion of the tools and techniques available now shifts to focus on those cases where the criteria can not be directly measured at collection sites. For example in determining the effectiveness of educational efforts, the level of awareness among the target audience, their perception toward the practice being considered, their individual background and demographics and perhaps in double checking the use rates of individual practices.

In these instances the conducting of surveys has proven very valuable. For the purpose of BMP evaluation a survey can be viewed as a means for generating data through the administration of some sort of questionnaire that is designed to collect information regarding the specific criteria at hand. In conducting such surveys the options for distribution are wide but the materials needed generally include the following: 1) a questionnaire that targets the applicable criteria; 2) a method for distributing and returning the questionnaire, and, 3) a method for generating a data base for future analysis.

Selecting a Distribution Method

How does one undertake the process of developing and administering a survey. The first question that needs to be asked is how will the survey instrument or questionnaire be distributed. Along these lines, distribution can be accomplished in several ways. There is the direct interview approach were a marina representative takes the survey instrument in the field and actually interviews the target audience by walking them through the individual questions. In contrast to this face to face approach, self-administered questionnaires may also be distributed by either placing them on the individual vessels stored at the facility at any given point and returned to a collection site

preferably within the marina office; or they can be distributed through mailings which include clear instructions and a postage paid envelop for completing and returning the enclosed questionnaire.

Considering the time required to personally interview enough marina tenants to generate valid findings, and in being concerned that face to face interactions would result in the respondents being less than honest with their answers the self-administered and anonymous approach was then selected for use by this project and is recommended for future use by others. Taking the design of the distribution method a step further the decision was then made to include the questionnaire in a mailing so that the respondents anonymity could be further assured and therefore their honesty fostered.

Developing a Questionnaire

With the distribution method selected the actual questionnaire can then be developed. Recognizing that it is impossible to give a clear description of what precise questions should be included and how the instrument should be formatted for individual practices, the following discussion focuses on the general concerns for developing the survey instrument rather then on the actual questions. As a starting point for discussion and as a basis for formulating your own questions please refer to Appendix A which contains the exact questionnaire distributed through this project.

As far as general guidelines for the development of questionnaires goes there are generally four topics which should be considered, the first of which involves the clarity of the writing style. In developing your instructions, questions and responses be sure to be clear, use terms that the target audience will understand, avoid ambiguous terminology, and provide room for the respondents to voice their own opinions and

include answers which may not be given as one of their original choices. Along these lines always try to structure questions and answers so that only one response is applicable. This will help in avoiding future analysis problems. The second topic which should be considered is the length of the survey. In general it is helpful if the actual questionnaire can be kept to a single page so that the respondents do not see the completion of the instrument as a formidable task which will take up considerable time. Try to keep the time needed to complete the questionnaire to under ten minutes. Lastly, always test the questionnaire on a sample of the boaters so that any problems with its wording and or structure can be identified and addressed before its actual distribution.

Databases and Outputs

Once the final questionnaire has been tested and distributed, further efforts should focus on the development of a suitable database in which to record the incoming information and to anticipate a display framework for the expected outputs. In accomplishing this task for this project, a computerized data base program was selected to process the incoming information and to generate the necessary output tables which would provide the basis for evaluating the survey responses. Current applications suitable for this task include Microsoft Access for PC based platforms and File Maker Pro for Macintosh based platforms. Sounding more difficult then it actually is, marina operators who have a general knowledge regarding the use of personal computers should have no problems in using the instructions provided with the software to develop their own database and to generate the expected outputs. If marina operators do not have such capabilities then outside consultants could be brought in to accomplish the task for them.

With the database established all that needs to be done is to enter the individual survey responses as they are returned to the marina office.

Data Compiling and Analysis

Once all of the responses to be considered have been entered into the database all that remains to be done is to complete the needed queries and to tally the results into the predetermined tables. The tables can then be used to analyze the results of BMP implementation. If desired marina operators can expand the initial analysis by doing more detailed cross comparisons which plot differing variables against one another to target specific audiences in need of special attention (as exemplified in section one). In concluding this discussion on conducting surveys, there is one last element that needs to be addressed and this involves the recording of the specific written comments made by the respondents on the actual questionnaires. In these instances the specific comments should be written down somewhere and organized by the category in which they fall and as to how many times the comment was repeated by other customers. Tracking this information as described will then allow the person conducting the survey to get a handle on those hard to reach perceptions and sentiments of the actual users toward the individual practices.

Suggestion Box/Comment Sheets

As mentioned above the soliciting of user perceptions and sentiments towards BMPs is very important in correctly assessing their current and/or potential cost effectiveness. In addition to the use of the comment sheets discussed under conducting surveys, consider using a suggestion box to solicit additional information. Placed within the marina, encourage both staff and tenants to share their feeling through anonymous

written comments deposited in the box. After a given period of time empty the box and tally the suggestions onto the master comment sheet as described above. Lastly, and in concluding the discussion on the tools and techniques available for gathering data, always take advantage of the personal communications which exist between staff and customers. Perhaps one of the most overlooked methods is the ability for marina operators to go out and simply discuss the implementation efforts with the customers in an informal and unstructured manner. When highly relevant sentiments or ideas for improving a practice arise, then make every attempt to include them on the applicable comment sheets.

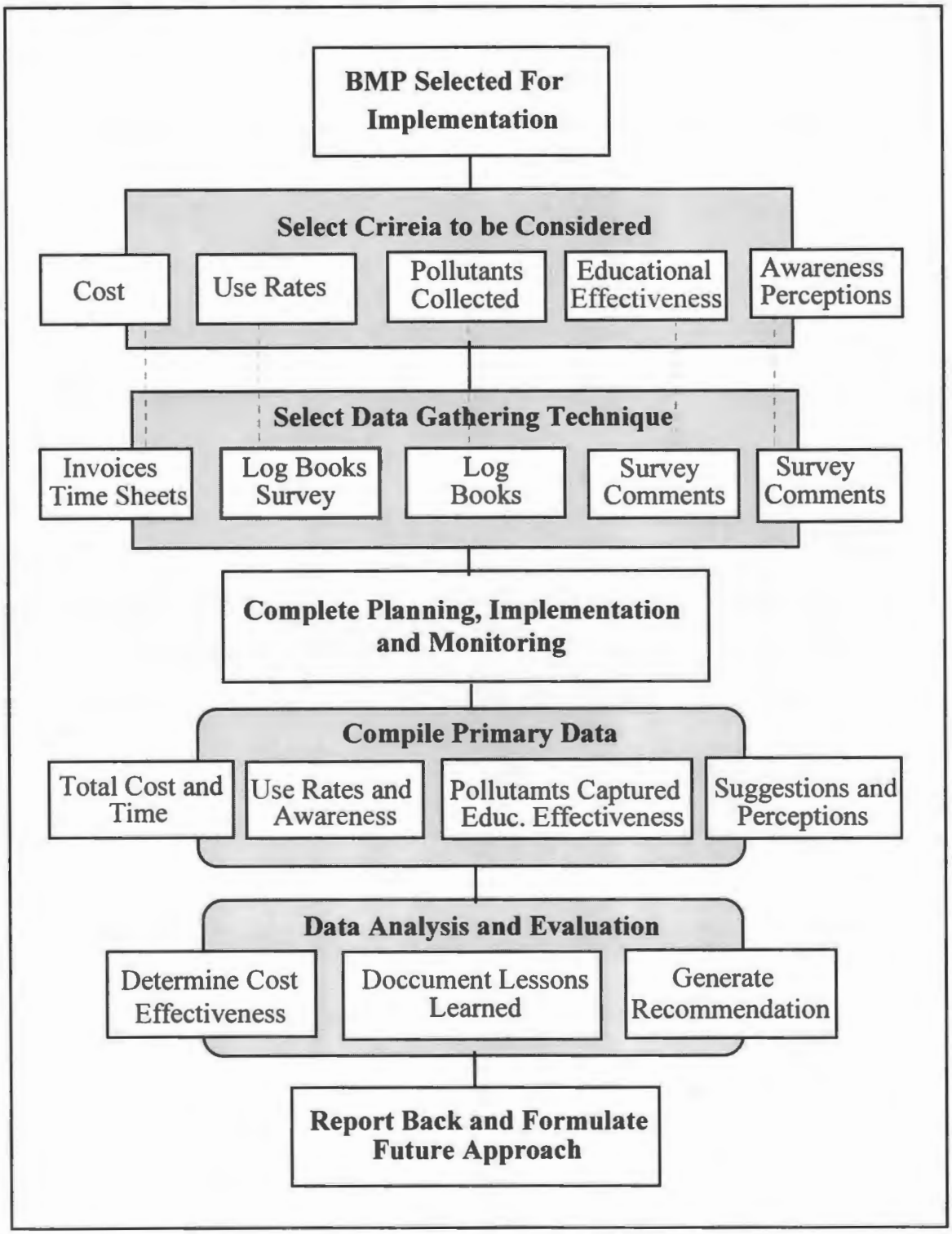
Developing a Strategy

Now that the reader has been given a preliminary understanding of the baseline criteria that should be considered and the general tools and techniques available for gathering and analyzing date, we will now examine the actual process used to develop monitoring and evaluation strategies for the BMPs implemented and evaluated through this project. In providing guidance to those developing their own strategies, the discussion will not only reflect on the experience at hand but will also embellish by presenting alternatives that were not necessarily used in this instance. Based on an individual BMP, the entire process as presented is depicted in Figure 15 - BMP Evaluation Process.

Selecting the Criteria to be Considered

Once the individual BMP to be addressed has been selected, the first task is to determine which criteria to use in its evaluation. In most instances the criteria will include the cost to fully implement the practice, its use rate, amount of pollutants

Figure 15 - BMP Evaluation Process



collected, the level of user awareness, and their perceptions toward the practice. Regarding educational BMPs, in most instances an additional criteria will need to be substituted for the amount of pollutants collected. That being the practices educational effectiveness or the ability for the approach to get the target audience to use BMPs. In proceeding with this process always keep in mind that no one criteria will usually be sufficient for a successful evaluation effort. In most instances a set or system of criteria will be required to fully evaluate the applicable practice.

Selecting a Data Gathering Technique

With the criteria selected, the focus for developing the overall strategy should then shift to examine the tools and techniques that could be used to gather the necessary data. Generally speaking: 1) costs should be acquired through the use of invoices and time sheets; 2) pollutants collected through log books; 3) use rates through log books and surveys; and, 4) educational effectiveness, user awareness and perceptions through the use of surveys and suggestions/comments. Once the techniques to be used have been selected, planning, implementation and monitoring will need to be completed. As similar to selecting the criteria to be used, keep in mind that although a singular data gathering tool may be effective in correctly capturing the applicable criteria, a system of techniques may prove more useful in that they can allow the cross comparison or double checking of the results produced by any one method alone.

Compiling, Analyzing, and Evaluating Data

After completing the planning, installation and monitoring aspects of BMP implementation, the compiling and analysis of the collected data may begin. The first task in completing this process should be to determine the total cost for implementation,

the use and awareness rates achieved, the pollutants collected or educational effectiveness identified, and the user's general perceptions and suggestions toward the practice. Following this, the analysis should then be initiated by synthesizing the applicable criteria into final statements of the practices overall cost effectiveness.

Carrying the cost effectiveness aspect further, the final stages in conducting BMP monitoring and evaluation should then proceed by documenting the lessons learned and by generating recommendations for their future implementation and use. Completing the evaluation in this fashion then allows individuals not only to generate their own action plans for future BMP implementation efforts; but, also provides several physical outputs which then can be used to transfer the experiences that they have gained among industry colleagues and the regulatory community.

Setting a Schedule and Following Through

Once BMP Implementation Plans and their associated monitoring and evaluation strategies have been formalized it is then time to carry out the planned activities. In summary it can not be emphasized enough as to how important it is to start early, stay on track and follow through with BMP monitoring and evaluation efforts. By way of review, remember that monitoring and evaluation of BMP implementation can result in: 1) a clearer understanding of BMP selection and use; 2) greater reductions in the fiscal demands placed on this important economic coastal industry; 3) improved cooperation and collaboration between industry and regulatory representatives; 4) the development of better environmental policy and compliance procedures; and, 5) a more efficient overall nonpoint source pollution control program with greater national gains in water quality. In

conclusion, even though this importance may not be fully appreciated as of yet, keep these concepts in mind while proceeding through the following section. It serves nicely to exemplify the importance and benefits produced through monitoring and evaluation while also drawing together the previous section's discussions into tangible outputs in the form of BMP case studies.

INDIVIDUAL BEST MANAGEMENT PRACTICE IMPLEMENTATION EXPERIENCES

Having presented strategies helpful in the selection, implementation and evaluation of BMPs in general, the focus now shifts to the nine practices actually tested at the five participating marinas. Categorized by solid waste, liquid waste and educational efforts, case studies follow for the individual BMPs addressed (see Table 3 for a complete listing). In capturing the experiences gained, each case study provides: a general description of the practice; a summary of the implementation and evaluation processes used; an explanation of the associated costs, pollutants collected and overall effectiveness; and concludes with final statements regarding the lessons learned and recommendations generated for the future use of these individual practice. Meant as a primary resource for marina operators and coastal regulators considering the use of the specific BMPs, the case studies provided also highlight the importance and value of monitoring and evaluation efforts as discussed in the preceding section.

Table 3 - BMP Case Studies Produced

Solid Waste BMPs *(pages 41-46)*	**Liquid Waste BMPs** *(pages 46-57)*	**Educational BMPs** *(pages 57-66)*
1. Vacuum Sanders *(page 41)*	3. Separate Collection Facilities *(page 46)*	7. Distributing Literature *(page 57)*
2. Recycling *(page 43)*	4. Secondary Containment *(page 49)*	8. Posting Signs *(page 60)*
	5. Spill Response Equipment *(page 52)*	9. Conducting Workshops *(page 62)*
	6. Spill Response Plans *(page 55)*	

Solid Waste Best Management Practices

1. Using Vacuum Sanders

Description

The vacuum sander targets paint chips and other debris produced through hull maintenance activities such as bottom sanding. As opposed to traditional equipment, this machine's sanding surface is ventilated to allow the attachment of a vacuum device which automatically collects debris as it is removed from hull surfaces and before it can reach the open environment.

Implementation

The equipment purchased was the Fein Dust Free Basic Sanding System (for your local Fein distributor call 1-800-441-9878). Once acquired, the equipment was then used by staff and made available for tenant use at no cost. Tenants were notified by word of mouth, the mailing of two informational flyers (see Appendix C) and through the posting of these same flyers within the participating marinas.

The equipment was managed on a first come first serve basis. Both staff and tenants were instructed on proper operating procedures before using the equipment and asked to fill out a brief questionnaire upon returning it (see Appendix C). The collected information was then compiled with the amount of material collected by the machine to establish a basis for evaluating its effectiveness.

Evaluation

Cost: $1,357 in equipment with an additional $50 in time and printing.

Pollutants Collected: With an estimated collection rate of 98 percent (Grlovich, personal communication, 9/19/96) and in using standard 80 grit sand paper, this particular

vacuum sander prepped 1,383 feet of vessel bottoms and in the process collected 171 pounds of bottom paint debris. By calculating a ratio we can see that the machine averaged 1.98 ounces of collected material per foot of boat sanded.

Cost Effectiveness: With the project survey identifying that only 50 percent of the responding boaters actually sanded their hull this year, one may ask what the potential impact of institutionalizing the use of vacuum sanders would be? Well in looking at the bigger picture, consider this: If just 35 percent of the State's 32,052 registered vessels (McGrath, personal communication, 9/19/96) used this type of equipment to sand their hulls each year, at an average length of 20 feet/per boat (McGrath, personal communication, 9/19/96), approximately 27,765pounds of solid waste could potentially be prevented from reaching the open environment annually.

When considering the individual installation of these machines, the initial purchase cost appears to present a barrier to such wide spread use, but recent studies have shown that this is not necessarily the case. According to Ross 1996, in addition to cleaning up the environment the use of vacuum sanders can dramatically increase the efficiency of sanding operations while also generating significant profits through customer rental.

Lessons Learned and Recommendations generated for Future Implementation

- Thoroughly research the market before purchasing any one specific machine. Compare the overall cost, size of powerheads, quality of vacuum motors and filters, and the details of the individual warranties and product support plans.
- If so desired, develop a rental scheme to compensate for the initial investment. It can

either be set up strictly to cover the cost of purchasing and operating the equipment, or it can be structured so as to become a profit center for the marina. Just remember that over the long run the lower the cost to the user, the more users you will have and the more pollutants you will capture.

- Publicize, publicize, publicize. If you do not get the word out, the machine will not be used enough to make a return (either in profits or pollutants collected) on the initial investment.
- In addition to the mailing or posting of flyers, consider posting permanent signs in hull maintenance areas which note that the equipment is available for tenant use.
- Do not forget about the benefits of the word-of-mouth technique. Inform staff that whenever they see someone sanding with traditional equipment they should advise them that a professional vacuum sander is available for their use which is more efficient and will protect their health as well as that of the environment.
- Always provide users with operating instructions and make sure that they understand them before using the machine. Take any steps necessary to limit liability on the part of the marina should something go awry.
- Monitor the use and materials collected by the equipment for future reference. Such information could prove invaluable in making decisions regarding the continuation of the vacuum sanding program and/or regulatory compliance.

2. Recycling Glass, Tin and Plastics

Description

Like homes, boats and the marinas at which they are stored, produce many

recyclable waste streams. But unlike most municipal neighborhoods, marinas often do not recycle these products due to the fact that the service is not provided to them by local municipalities. Recognizing this, the aim of this BMP was to properly dispose of these solid wastes by privately providing recycling facilities for tin, glass and plastics.

Implementation

To accomplish this standard 96 gallon recycling totes were provided to two of the participating marinas by two different private waste disposal contractors for the collection of tin, glass and plastics. The two marinas were of similar size in that the first has 248 berths and the second has 256. In implementing the practice both marinas placed the totes at the head of their main piers, and adjacent to the primary. All recycling totes were labeled as to what they were designed to collect.

In regards to educating marina tenants on the use of the facilities, whereas most individuals understand what to do upon recognizing the totes and reading their labels, the second marina distributed additional educational flyers to each of the tenants (see Appendix D). The final step in implementing this practice involved establishing an evaluation scheme. This was accomplished by monitoring the volume of material collected prior to the weekly emptying of the totes and by comparing it with the cost for standard disposal.

Evaluation

Cost: The cost for providing this service averaged $32 per week, per marina.

Pollutants Collected: The two marinas averaged 1.95 full 96 gallon totes per week or the equivalent of 16.25 percent of a standard six yard dumpster's capacity.

Cost Effectiveness: In terms of properly disposing of solid wastes it is felt that this practice was effective in that it prevented re-useable materials from being permanently discarded. On the other hand, the overall cost effectiveness is questionable in this instance due to the fact that it cost substantially more to recycle the material using a private waste hauler than to simply have disposed of it using the dumpsters that were already available. For example, the average cost to provide and empty a standard six cubic yard dumpster was $36.00 per week. When you consider that it cost $32.00 per week to recycle what could have been disposed of in the dumpsters for $5.12, one can see that although recycling is the environmentally preferred disposal method, it is not economically efficient under these circumstances.

Lessons Learned and Recommendations generated for Future Implementation

- Recycling is undoubtedly the environmentally preferred disposal method.
- Although the practice has proven environmentally effective, due to the fact that private service providers tend to be costly in the provision and emptying of recycling facilities, this method has therefore proven to be economically inefficient in this instance.
- Recycling of tin, glass and plastics can be become economically efficient if its cost can be made compatible with the fee for standard disposal.
- Check to see if your municipality is willing to provide the service at a reduced fee.
- If not, try tackling the task in-house. Sufficient receptacles can be privately purchased and properly labeled for a nominal fee.

- Of the survey respondents not recycling, 50 percent felt that the process took up too much space onboard their vessels and was too time consuming; therefore, try to simplify the procedure by providing commingled collection bins.
- Recyclables can then be disposed of at no charge by either bringing them to municipal collection sites or by encouraging local "scrapers" to collect the metals.

Liquid Waste Best Management Practices

3. Providing Separate Disposal Containers

Description

A major component in minimizing nonpoint source pollution is in providing proper liquid waste collection and disposal facilities. When people can not easily access such facilities, they tend to dispose of wastes such as oil, antifreeze and solvents in discrete and improper manners. In addition to preventing pollutants from being improperly disposed, having separate containers for the collection of differing liquid wastes can save on disposal costs. For example, it can cost anywhere from two to three times the amount to dispose of a 55 gallon drum of oil that has been contaminated with antifreeze ($400-$550) than it would to dispose of an uncontaminated drum ($150) of pure waste oil (Kailer, personal communication, 9/27/96).

Implementation

Reconditioned 55 gallon drums with lids were purchased from a local supplier identified through the yellow pages. These drums then served as the primary containers for the separate collection of diesel fuel and antifreeze. In order to ease the collection

process specially designed funnels that screw into the drums and provide sufficient room for the draining of portable containers and oil filters were purchased from the Oil Dri Corporation (for your local distributor call1-800 Oil Drip). All of the separate disposal containers were then labeled as to what they were designed to. The necessary labels were produced in 4 inch white vinyl a local sign maker identified through the yellow pages.

Once acquired, the drums were labeled, affixed with a funnel and placed atop the two drum secondary spill containment pallets (BMP case study - 4)). Notifying the marina's tenants was then accomplished in several manners. Signs were posted at the applicable marinas directing patrons as to the proper methods for disposing of harmful materials; and educational fact sheets were also distributed (see BMP case studies - 7 and 8). The final step in implementing this practice involved establishing an evaluation scheme. Originally the plan was to have the participating marina operators keep logs which recorded each individual deposit of liquid wastes into the collection containers. Upon further discussion with the marina operators, the decision was then made to simply record the volume (in gallons) of material collected over the course of the boating season.

Evaluation

Cost: Drum-$14.95, funnel-$35.00, label-$8.00 (minimal installation time)

Pollutants Collected: Zero pollutants were collected at the two facilities implementing this BMP for diesel fuel and antifreeze, but to put this in proper perspective a few points must be emphasized. One, antifreeze is predominately produced as a waste product during the early spring when people are de-winterizing or commissioning their vessels for summer use. Two, these facilities were not up and running until after this period. And three, two other participating marinas which did have these facilities in place

averaged approximately 40 gallons of antifreeze, 350 gallons of diesel plus 17 gallons of gasoline, and 10 gallons of solvents.

Cost Effectiveness: In this particular instance the true cost effectiveness of this BMP as planned for implementation at the two participating marinas can not be determined due to the fact the facilities were not able to be installed until after the primary demand had ceased. On the other hand, if we consider the volumes collected at the two participating marinas which had the pre-existing facilities and the increased cost to dispose of contaminated wastes, we can quite clearly make the conclusion that a minimal investment in separate collection containers for disposal of liquid wastes can increase the amount of materials properly disposed while also decreasing the actual disposal cost over the long run.

Lessons Learned and Recommendations generated for Future Implementation

- Carefully assess your needs for separate collection facilities. Full service marinas will generally produce more waste streams than those who cater primarily to hauling and storage.
- At a minimum consider providing separate facilities for the disposal of: waste oil, diesel, gasoline, antifreeze, solvents, and contaminated petroleum products (i.e. oils mixed with such things as antifreeze and/or water).
- Remember, if it costs $60 to install a separate container for the collection and disposal of waste oil that has been contaminated, but it takes two to three years to fill the drum, you still may be achieving a savings in disposal costs of between $200 and $300.

- The cost to provide separate disposal containers can be drastically reduced by re-using drums that you may already have on-site. Labels do not necessarily have to be purchased, they can simply be painted on and although a snug fitting funnel for draining temporary containers is a plus it is not the only alternative.
- Design collection facilities so that they are easy to access. 57.5 percent of the survey respondents indicated that they did not use the provided facilities because it was easier to dispose of their wastes elsewhere. If possible, try to keep them open throughout the season and always make sure that sufficient capacity exists.
- If it is not possible to keep them open or unlocked, consider providing a "drop off booth" at some convenient point within the marina.
- Publicity, education and proper instruction is key. In order to reduce those discrete and improper disposal practices of your staff and tenants they must: one, be aware of the facilities available to them; and two, know how to correctly use them.
- Along these lines consider posting signs in the collection area describing disposal methods, distributing flyers and labeling containers appropriately (see the educational BMP case studies for additional details).
- Remember check with local regulatory officials on specific design criteria for hazardous materials storage areas.

4. Installing Secondary Containment

Description

All containers used to store waste oils and other such potentially harmful liquids should have a form of secondary containment. The primary purpose being to provide

additional storage capacity for any materials which may leak due to the failure, overfilling or improper draining of the primary storage container. Generally speaking, secondary containment should equal 110 percent of the capacity of the primary container and is usually provided by placing a non-leaching berm with an impervious bottom under, or around, the primary container.

Implementation

In providing secondary containment to the liquid storage facilities at the participating marinas the decision was made to purchase commercially available products rather than constructing such facilities in-house. In all instances the product purchased was the Oil Dri Corporation of America's two drum spill pallet (product # 90525). Constructed to provide secondary containment for any two standard 55 gallon drums, these units can be easily transported in case of emergency and have been outfitted with spickets so that they may be drained of their contents when necessary. For your local Oil Dri Distributor call 1-800 Oil Drip.

Implementation of the secondary containment units was accomplished by first placing them in their designated storage locations. The primary containers (55 gallon drums) were then placed on top of the pallets and opened for use. Due to the transparent nature of this BMP to its users, no specific educational activities were warranted. The final step in implementing this practice involved establishing an evaluation scheme. Evaluation was accomplished by checking the amount of liquids that had collected in the bottom of the secondary containment units at the end of the boating season.

Evaluation

Cost: $241.00 each with minimal time for installation.

Pollutants Collected: One quart of liquid wastes was collected by one of the units. In this instance the leak was due to an improper filling of the primary storage container. If not for the presence of secondary containment this leaked material would have seeped directly into the ground.

Cost Effectiveness: These two drum spill pallets represent a very cost effective means for providing secondary containment. In terms of the pollutants collected, although only one quart of liquid wastes were captured this season, we are confident that these units would be capable of containing a complete failure of the primary storage containers placed upon them. In terms of economics, it is felt that the initial purchase cost for these high quality units is either equal too or less than the cost to produce a similar product in house. In concluding, it is also important to recognize the inherent benefits of the spill pallets design. These being that they are durable, moveable and equipped for draining.

Lessons Learned and Recommendations generated for Future Implementation

- Proper secondary containment facilities are effective in controlling both small leaks or spills and larger failures of primary storage containers.
- Secondary containment facilities should be regularly drained of any collected material so that their capacity at any point in time is equal to 110 percent of the primary storage containers.
- When standard 55 gallon drums are used as the primary storage containers, it may be

cheaper to purchase commercially available containment units rather than trying to construct such facilities in-house.

- If larger storage containers are used to store liquid wastes it may become more difficult to provide secondary containment. In these instances consider removing the larger tanks and replacing them with a series of standard 55 gallon drums and spill pallets.
- As another alternative to replacing large tanks, consider the construction of a central collection site. A particular method worth noting is the use of septic tanks cut in half and enclosed. This approach can provide secondary containment for large quantities of liquid wastes. Remember that in many states any storage facility which has the capacity to hold more than 500 gallons of petroleum products must be permitted (check with your department of environmental management).
- When constructing such facilities in house be sure to consider such design elements as overall capacity in comparison to the capacity of the primary containers, and their ability to be transported and drained.
- Spill pallets capable of holding four 55 drums are also commercially available. With the capacity for four drums, these pallets can either be used for different types of liquid wastes (i.e. one drum for oil, one for antifreeze, one for solvents etc.) or to replace a larger container used for a single waste product.

5. Supplying Emergency Spill Response Equipment

Description

Oil spills resulting from marina related activities pose a real threat to coastal environments and can impose considerable financial liabilities upon individual marina

owners and operators. Recognizing this, the ability to quickly contain and absorb such spills then becomes crucial in mitigating these potential negative impacts. In order to contain and absorb such spills, a certain amount of specialized equipment is recommended to be kept on-site. At a minimum this equipment should include: a sufficient length of boom (approximately three feet of boom to every foot of the largest vessel serviced) capable of containing spills and a sufficient quantity of materials capable of absorbing oil in a liquid environment (*Environmental Guide for Marinas*, 1996)).

Implementation

In this instance the spill response equipment decided upon was the Oil Dri 95 Gallon Oil Only Spill Kit (# 90943). Containing 130' of boom, 60 smart pads, 10 disposal bags, and an emergency response guidebook, this kit has the ability to absorb 164 gallons of fuel (Oil Dri Corporation, 1994). For your local Distributor call 1-800-Oil Drip.

Once acquired the emergency spill response kit was permanently installed at the marina's fuel dock. After considerable consideration the decision was made to leave the provided storage container unlocked so that the equipment could be accessed at all times by the marina's tenants. In order to raise awareness of the equipment's existence, a sign detailing the basics of oil spill response was created and posted at the fuel dock (see Appendix F for the sign's exact language).

Evaluation was then accomplished by keeping track of the number of products actually used. In addition, any used products were to be collected and drained to determine the amount of oil which had been prevented from entering the open

environment. In the event that a large spill occurs the response kit was to be evaluated as to its effectiveness at containing the spill.

Evaluation

Cost: $496.00

Pollutants Collected: No instances arose at the participating marina where the deployment of the emergency spill response equipment was warranted. Therefore no actual volumes were collected and able to be measured.

Cost Effectiveness: Although the equipment was never actually used by the participating marina, it is felt that this kit is fully capable of absorbing the 164 gallons of oil that the manufacturer claims. Assuming that this is true, when compared with the high costs associated with having a private company respond to a 100 gallon oil spill one can see that the purchase cost of an emergency spill response kit of this caliber is well worth the initial investment.

Lessons Learned and Recommendations generated for Future Implementation

- An ounce of prevention is worth a pound of cure. Look at your marina with a critical eye. Try to identify and correct potential spill sources before they occur.
- If the cost for the purchase of a complete emergency spill response kit seems to high, consider buying booms and absorbents separately and constructing a storage container on your own.
- Equipment does not necessarily have to be purchased all at once. Small sections of boom and bales of absorbents can be purchased individually over time.
- Before deciding on the locking of the storage container, try leaving it open so that

tenants can access the equipment at any time.

- Consider leaving the storage container unlocked just on weekends and holidays when there is more activity and therefore more potential for spills within the marinas.
- Both staff and tenants need to be educated on the use and disposal of emergency spill response equipment. Use signs, educational literature and perhaps workshops to instruct them on the proper use of the equipment (see case studies 7-9 for more information on educational methods).
- Develop and maintain a spill response plan (see BMP 6 below).

6. Developing Spill Response Plans

Description

Simply having the proper equipment available for responding to oil spills is not enough to ensure proper oil spill response and clean-up efforts. An Oil Spill Response Plan clearly identifies the who, what, when, where, and how of spill response for a particular marina. In its most basic sense, the oil spill response plan is simply a proactive safety device which outlines a set of procedures for correctly responding to such an emergency.

Implementation

If proper oil spill response equipment is already available, there is almost no need for additional capital outlays in the development of a spill response plan (if not see case study 6 - emergency spill response equipment). Recognizing the above, what will be needed is a good reference source that details the process for developing such a plan.

In this instance the *Environmental Guide for Marinas* was used as the reference source in completing the individual spill response plans. Two meetings were then held at which marina management: identified potential spill threats; agreed upon spill response tactics; designated specific personnel with specific roles; and, identified contacts for additional spill response equipment

Evaluation

Cost: Approximately 4 person hours to research and develop the plan with an additional 2 person hours for staff review and instruction.

Pollutants Collected: As mentioned in the emergency spill response equipment case study, no actual events occurred which allowed the spill response plans to be implemented. Therefore we have no information on which to estimate the amount of pollutants collected, or in this case, prevented from reaching the open environment, as a result of having developed a spill response plan.

Cost Effectiveness: Considering that the implementation cost for this BMP is extremely low, it is felt that the development of spill response plans can be very cost effective. The primary benefit being that the appropriate individuals can then train to respond to the potential threats identified; become more aware of the procedures to follow in the event of a spill; know where and how to access the necessary response equipment; and can therefore better respond to actual emergencies.

Lessons Learned and Recommendations generated for Future Implementation

- The development of spill response plans is straightforward, inexpensive and can be easily accomplished by staff without the assistance of costly private consultants.

- The *Environmental Guide for marinas* serves as an excellent resource for the development of spill response plans.
- The process of developing the plan with staff is an educational experience in and of itself, but training in actual spill response is most helpful.
- Properly informed actions on the part of marina representatives in the early phase of spill response has the potential to reduce cleanup costs and potential liabilities.

Educational Best Management Practices

7. Distributing Literature

Description

Distributing educational literature is often cited as a primary means for informing boaters on nonpoint source pollution controls for marinas. In most instances undertaking this approach depends on three primary factors, these being what types of literature to use, where to acquire it and how to distribute it. In regards to the information types, flyers, posters, short booklets and fact sheets are commonly cited. Although these types can be produced in-house on a case by case basis, their most likely source is through governmental and non-governmental environmental organizations and also through industry related trade associations.

Implementation

In distributing literature the first task was to acquire a good source material that was widely applicable, accurate, appealing and concise. In finding nothing like this available at the time, the author then coordinated CRC/Sea Grant's and the NBEP's

production and publication of a Boater Fact Series that covers the topics of sanding and painting; solid waste disposal; vessel sewage; bilges, fueling and spill response; vessel cleaning and fish waste; and routine engine maintenance (see Appendix E).

With the necessary literature on hand, two different distribution methods were then selected and tested. More specifically, the first method involved the use of standard literature display racks that were set up at convenient locations within three of the participating marinas, stocked with materials and monitored as to how many individual fact sheets were taken each month by the marinas customers.

The second method on the other hand, involved including one of the fact sheet series in each of the five marinas monthly billings over a course of six months. For example, in trying to have the content of the fact sheets coincide with the activities of boaters during different times in the season, the sanding and painting fact sheet was then mailed at the end of April, solid waste disposal in May, vessel sewage in June and so on. After completing the six month distribution process, the monthly mailing method was then evaluated through the use of a survey which asked the marina customers: 1) if they had been reading the individual fact sheets; and 2) if they were now using any BMPs that they had learned from reading them.

Evaluation

Cost: The costs associated with the display rack approach averaged $52.80 per marina ($45 to purchase the rack and $7.80 to stock it with 20 copies of each fact sheet). The cost for the monthly mailing approach on the other hand averaged $45.36 per marina ($7.56 for copying per month times 6 months).

Educational Value: In this instance educational value refers to the effectiveness of the approach in persuading the audience to use new BMPs. Along these lines, through the survey we then identified that distributing literature ranked second among the customers choice for best method of informing them. Additionally, 75% of those who received the fact sheets actually read them, and of that 75%, 91% have since begun to use BMPs which they learned through reading the materials.

Cost effectiveness: Although distributing literature through the use of fact sheets has proven highly effective in its ability to get boaters to use BMPs and it is undeniable that there is not a large difference regarding the costs of the two approaches used, one method was much more cost effective then the other. For example, whereas the monthly mailing approach managed to distribute an average of 126 copies per month per marina, the literature display rack averaged only 5 copies per month per marina.

Lessons Learned and Recommendations generated for Future Implementation

- Distributing literature ranked second among the boaters choices for best method of informing them and had the highest effectiveness rating of the three educational BMPs addressed, therefore the use of this approach is highly recommended.
- Rhode Island Sea Grant now has a series of six boater fact sheets available that represent a widely applicable, accurate, appealing and concise source material.
- Distributing literature through monthly mailings was far more cost effective in reaching the masses than simply using displaying racks due to the fact that the participating marinas were paying for the postage regardless of the inclusion of the individual fact sheets.

- If the use of monthly mailings are not applicable in a specific instance, consider sending them out with the seasonal contracts or having copies placed directly on the individual vessels stored at the marina over different points in the boating season.
- But, perhaps the most important lesson that we have learned about this approach is that you can not expect the customers to simply take the information. For this approach to be truly effective you have to put the material directly in their hands.

8. Posting Signs

Description

The use of signs has long been recognized as a means for informing people. In this instance the tactic was used to educate boaters on specific BMPs which they can use to help reduce nonpoint sources of pollution from marinas.

Implementation

The first task in this instance involved categorizing and compiling the material that needed to be conveyed into logical topics which would be appropriate for posting at different locations within the facility. In working within the different facilities needs we then identified several consistent priority topics for signs including solid waste disposal tips, harmful materials or liquid disposal tips, and instructions for responding to spills and the operation of vessel sewage pumpout stations.

With the topics decided the specific language was then developed (see Appendix F) and the production of the signs was contracted out to a local sign maker. Constructed of steel with vinyl backgrounds and lettering, once delivered the 36x24 inch signs were then posted in appropriate places. For example, Solid Waste Disposal signs were placed

near all of the facilities dumpsters; and spill response instructions were placed next to the facility's spill response equipment. After completing the installation of the signs, this educational approach was then evaluated through the use of a survey which asked the marina customers: 1) if they had learned new waste BMPs through reading the signs; and 2) if they were now using the practices which they learned.

Evaluation

Cost: $105.00 per sign with minimal installation time.

Educational Value: In this instance educational value refers to the effectiveness of the approach in persuading the audience to use new BMPs. Along these lines, through the survey we then identified that the posting of signs ranked first among the customers choice for best method of informing them. Additionally, 72% of those who read the signs learned new practices, and of that 72%, 79% have since begun to use the newly learned practices.

Cost Effectiveness: In retrospect, the cost that was paid for the individual signs initially appears high when compared with the costs associated with distributing literature. But, when one recognizes that the literature will usually only serve a one time benefit whereas the signs will spread their messages to various individuals over the course of years, one can see that the approach can become more cost effective over the long run.

Lessons Learned and Recommendations generated for Future Implementation

- The posting of signs was ranked by boaters as the best method for informing them and also ranked second in terms of its effectiveness in getting boaters to use BMPs.

- Priority topics for the posting of educational signs include solid waste disposal, liquid waste disposal, pumpout station operation and spill response instructions.
- Developing the specific language for such educational signs does not have to be difficult (check Appendix F for the language used in this instance).
- Although signs need to be durable legible and eye catching they do not necessarily have to cost hundreds of dollars. In many instances they can simply be improvised with some wood and a little paint.
- In order to be effective, signs need to be visible to all, even if that means making several copies of the same sign and posting it in different locations.
- Lastly, make sure they are of a suitable size and post them in locations where they make sense.

9. Conducting Workshops

Description

The *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (EPA, 1993) states that "meetings/presentations at local marinas or other locations are a good way to discuss (nonpoint source pollution) issues with boaters." In this instance, the conducting of several such events or workshops has been undertaken to assess their value.

Implementation

In conducting educational workshops for the boaters at each of the five participating marinas the first task involved cataloging and categorizing the materials that needed to be presented. Once this task was complete, three different formats were then

selected for use, these being the question and answer forum, slide show presentation and walking facility tour (see the session plans contained in Appendix G for the actual content and organization of the two formal approaches). In addition to using three different formats, four different settings were selected: 1) the walking facility tour approach was obviously conducted at the marinas; 2) the question and answer forums also took place at the marinas, but in one instance the event was scheduled into an existing function traditionally well attended by the customers; 3) the first slide show presentations was scheduled for a large local boating supply store; 4) and the second was held at an adjoining restaurant and conducted over appetizers and refreshments provided by the marina operator.

With the actual content, organization and location of the events finalized, the focus for their planning then shifted to publicizing the various events. Although the approaches used varied slightly between the marinas, for the most part publicity flyers (see Appendix G) were posted throughout the participating facilities and mailed, on two occasions, to the marinas tenants. The one-stand out in regards to the publicity approach used, regards the slide show presentation held at the local boating supply store. In this instance and in addition to the methods discussed above, the store was given 200 more flyers which were then handed-out to the stores customers over a two week period preceding the event.

Once the preparations were complete the actual events were conducted in accordance with the individual session plans. The basis for the proceeding evaluation was then established through the mail out survey which asked the marinas tenants the following questions: 1) Were you aware of the workshops? 2) Did you attend? 3) If you

did attend, are now using the BMPs discussed? 4) If you did not attend, what would have encouraged your participation?

Evaluation

Cost: Except for the publicity efforts (averaged $16.00 per facility) and the slide show presentation conducted over appetizers and refreshments, there were no large costs associated with purchasing needed equipment or materials for the individual workshops. On the other hand, one must recognize that it takes a *considerable investment of time* to plan and conduct a successful formal workshop. On the average , 10 hours were needed to plan and publicize the events, 2 to gather any needed materials, 3 to advise any additional speakers, 2 to do a preliminary dry-run, and an additional 3 to setup, conduct , and cleanup after the actual event.

Educational Value: In this instance educational value refers to the effectiveness of the approach in persuading the audience to use new BMPs. Along these lines, through the survey it was then identified that conducting workshops ranked last among the customers choice for best method of informing them. Additionally, of those who were aware of the workshops only 9% chose to attend. Of those who attended only 31% have since begun to use BMPs which they learned at the events.

Cost Effectiveness: When comparing the average investment of time and resources for the preparation and conducting of the formal workshops with the 9% attendance rate observed and the approaches associated 31% effectiveness at getting participants to use BMPs, it is felt that the conducting of such events is not nearly as cost effective or viable an approach as the others evaluated.

Lessons Learned and Recommendations generated for Future Implementation

- Conducting workshops ranked last in the best methods to inform boaters question, experienced an attendance rating of only 9%, had the worst effectiveness rating of the three educational approaches tested and was not very cost effective. Therefore its use is not generally recommended.
- The effectiveness of the approach can increase however with improved attendance.
- If conducting workshops is chosen, focus on traditional publicity methods such as word of mouth and the posting and mailing of flyers, but more importantly try to schedule the event into an existing marina function that is traditionally well attended by tenants. This will give you a large captive audience with minimal effort (as was achieved with the breakfast event discussed above).
- To further boost attendance try offering some types of incentive such as door prizes, discounts, free product samples or even a small social event afterwards (such as was done in the above mentioned restaurant example).
- In terms of workshop formats the walking facility tour appeared the best method used in that it allowed the participants to gain hands on experience in the benefits and use of BMPs through actual on-site demonstration of products and procedures.
- The slide show presentation appeared less effective than the walking tour but more effective then the question and answer forum in that it engaged the participants and allowed the opportunity for the presentation and discussion of appropriate BMPs.
- The discussion and answer format proved least effective in that it made it harder to engage the tenants.

- Finally, the conducting of successful formal workshops requires a considerable investment of time and perhaps resources. If sufficient time and resources are not available, it is better to reconsider rather than to conduct an event which may set negative tones for future BMP implementation, evaluation and education efforts.

Summary of Project Findings

In summary, all of the liquid waste BMPs implemented and evaluated proved effective and are therefore recommended for use. Of the two BMPs tested for controlling solid wastes, only the use of vacuum sanders proved cost effective under the circumstances given. Recycling of glass, tin and plastics should not be completely ruled out though, since the potential to reduce the cost of providing such a service has been identified and awaits testing.

In regards to educational efforts, it is felt that the distribution of educational literature and the posting of signs are the most effective and efficient of the three choices analyzed and therefore their use is also highly recommended. On the other hand, conducting successful workshops proved more difficult, had vastly inferior effectiveness ratings and was perhaps more costly to implement than both of the educational approaches discussed above. Therefore the conducting of such events is not generally recommended as a cost-effective means for educating boaters on nonpoint source pollution controls.

CONCLUSION

Information Sharing

Through the actual evaluation of solid waste, liquid waste and educational BMPs at five Rhode Island marinas, this report has not only been able to transfer the lessons learned and recommendations generated for the future use of nine individual BMPs for controlling nonpoint source pollution; but has also been able to document the experiences gained in: 1) characterizing the target audience for BMP implementation; 2) selecting priority practices for use; 3) developing implementation plans; and, 4) formulating monitoring and evaluation strategies. Recognizing that this achievement would not have been possible if the implementation efforts had been undertaken without a concern for evaluation, it is important to reemphasize that all individuals implementing BMPs for controlling nonpoint source pollution should follow through with this final aspect. This is important for the benefit of all the stakeholders involved, and equally so for the marinas themselves.

Although completing the evaluation of BMPs can provide individual marina operators with a competitive edge in reducing nonpoint source pollutants while also saving money and perhaps turning a profit; it is recommended that individuals share the knowledge that they gain with all of the stakeholders involved. Furthermore, when looking at this bigger picture, the sharing of information between various industry representatives and regulatory bodies can result in greater positive ramifications for all involved than if the same information was sequestered. For instance, if an individual marina can document that Practice X, as required by regulation, is inefficient and

ineffective; it could then result in the changing of policy requirements. Thereby benefiting the system of governance and industry as a whole through improved program implementation.

The Next Step - Regulatory Compliance

Perhaps the one remaining aspect of BMP implementation that needs to be briefly addressed before concluding involves the actual regulatory compliance procedures associated with CZARA section 6217 (g). As stated in section one, all marinas within the jurisdiction of Federally approved Coastal Resource Management Programs will have to submit (by 1999) some sort of "Operation and Maintenance Plan" to their applicable state governing agency that explains the selection and implementation of BMPs for the given facility. This discussion once again focuses on the Rhode Island example and remember that although the intent and tasks associated with differing state programs may be similar, their exact methods and requirements may differ. Always check with the appropriate local agency for program updates before beginning.

With the *Environmental Guide for Marinas* as the primary reference source, Rhode island marina operators should begin considering the development of Operation and Maintenance Plans as they inventory the BMPs to be addressed (see section two). Whether or not the actual document is written at that time, or some time after the final BMPs are implemented is totally up to the individual, provided that the 1999 deadline has not been reached. Once the actual compiling of the document has been initiated, Marina operators should then focus on completing the following two required elements.

The first required element is titled the Identified Activities Section and should be based on a site-plan which details the physical attributes of the facility and more importantly pinpoints the location of different BMPs within the marina. In addition to the site plan, this element should also include written descriptions as to the location of the facility, existing permits, boat capacity and existing slip layout, services provided, structures present, underground facilities etc. The second required element of an Operation and Maintenance Plan is the BMP Selection and Implementation Schedule. Essentially the heart of the plan, this element is completed by taking the checklist type worksheets contained in the guide and addressing each issue by marking the practices as either in use, planned for use, or not applicable for use at the particular facility in consideration. After checking the appropriate boxes simply provide the required explanation and continue on in this manner to all of the first eight worksheets have been completed.

With these two required elements complete all that needs to be done is to combine them, provide a cover sheet, and then submit the document for actual review. Prior to moving on, it is important to reemphasize that although differing states may have different policy frameworks and requirements, the general tasks to be completed in the development of operations and maintenance plans should be similar to those presented above. Always check with the appropriate local agency for program updates before beginning.

The Systems Approach and Additional Resources

In concluding, it is important to point out a final distinction in the implementation of nonpoint sources pollution controls for marinas. In most instances no one BMP will be completely sufficient in controlling a given source. Under most circumstances a system of multiple BMPs will be necessary to properly address these issues. For example, simply switching to the use of vacuum sanders will not completely mitigate the release of total suspended solids from hull maintenance areas, other BMPs such as the use of buffer areas or filtration basins may be needed. Additionally, although signs have proven effective at educating boaters, a combined approach of using signs and distributing educational literature may prove more valuable

A series of references and informational resources have been provided at the back of this document to assist in the selection, implementation and evaluation of BMPs for controlling nonpoint source pollution. Of special interest may be recent publications by Ross *(Clean Marinas - Clear Value: Environmental and Business Success Stories*) and the Rhode Island Department of Environmental Management (*Pollution Prevention Case Studies for the Marine Industry*) both of which contain additional BMP case studies for controlling nonpoint source pollution at marinas. In addition to these written documents, a series of useful personnel contacts and computer resources has also been provided. Of special interest will be the MarinaNet website and the International Marina Institute.

Appendix A

Sample Survey

The following is the exact survey questionnaire distributed to the boaters at the participating marinas.

Boater Questionnaire

(originally printed on one double side sheet of legal paper)

Please circle or check **the most appropriate response** to each of the following questions on **both sides** of this sheet. Where applicable, please feel free to fill in a response of your own. **Please return your completed questionnaire** in the self addressed, postage paid, envelope which has been provided.

Signs

1. Did the environmental signs posted at the marina inform you of new waste disposal practices?

	Yes	*No*
a) rubbish disposal(i.e. trash, garbage, etc.):	___	___
b) liquid waste disposal(i.e. gas, oil, antifreeze):	___	___
c) pump-out facility:	___	___

2. If you learned new waste disposal practices from the signs, are you now using them?

	Yes	*No*
a) rubbish disposal(i.e. trash, garbage, etc.):	___	___
b) liquid waste disposal(i.e. gas, oil, antifreeze):	___	___
c) pump-out facility:	___	___

3. If you haven't used these new practices, please tell us why not?

a) will have little impact
b) too expensive
c) too time consuming
d) equipment not available
e) need further information
f) other _____

Fact Sheets

1. Have you been reading the Boater Fact Sheets included with our monthly mailings?

	Yes	*No*
a) rubbish disposal:	___	___
b) sanding and painting:	___	___
c) bilges, fueling and spill response:	___	___
d) vessel sewage:	___	___

2. If you did read the Fact Sheets, are you now using the pollution prevention practices discussed?

	Yes	*No*
a) rubbish disposal:	___	___
b) sanding and painting:	___	___
c) bilges, fueling and spill response:	___	___
d) vessel sewage:	___	___

3. If you haven't used these pollution prevention practices, please tell us why not.

a) will have little impact
b) too expensive
c) too time consuming
d) equipment not available
e) need further information
f) other _____

Workshops

1. Last season, we held environmental workshops for our customers.

	Yes	*No*
a) Were you aware of these workshops?	___	___
b) Did you attend these workshops?	___	___

2. If you attended, are you now using the pollution prevention approaches discussed?

	Yes	*No*
a) rubbish disposal:	___	___
b) liquid waste disposal:	___	___
c) vessel cleaning:	___	___
d) fish waste:	___	___

3. If you did not attend the boater workshops, what would have encouraged your participation?

a) have workshops held on weekends
b) have workshops held on weekdays
c) different workshop content
d) more publicity
e) other _____

Miscellaneous

1. Which method is best for informing people of environmentally friendly boating practices?

a) signs b) fact sheets c) environmental workshops

2. What other methods should be used to best inform boaters?

a) film b) TV c) radio d) on-line e) boating magazines/newspapers f) other _____

3. How much would you be willing to pay, per season, for a cleaner boating environment?

a) $0 b) $1-$50 c) $51-$100 d) $101-$200 e) $201-$300 f) $301+

Dustless Vacuum Sander

1. Is there a dustless vacuum sander available for your use at the marina?

a) yes b) no c) not sure

2. If the equipment is available but you haven't used it, please tell us why.

a) will have little impact
b) did not sand hull this year
c) marina does boat maintenance
d) not enough machines available
e) machine is inefficient
f) other _____

Liquid Waste Disposal

1. How do you dispose of liquid wastes such as oil, gas and antifreeze?

a) put them in the marina's dumpster
b) take wastes home
c) dump wastes in water
d) others do maintenance
e) use marina's liquid disposal facility
f) other _____

2. Were you using this same practice two seasons ago? *yes* *no*

3. If your marina does collect liquid wastes but you dispose of your materials elsewhere, please tell us why.

a) too costly
b) always full
c) too time consuming
d) will have little impact
e) easier to discard wastes elsewhere
f) other _____

Recycling

1. How do you dispose of recyclable items such as aluminum cans, plastic and glass?

a) put them in the marina's dumpster
b) take them home
c) throw them in the water
d) use marina's recycling facility
e) easier to discard elsewhere
f) other _____

2. Were you using this same practice two seasons ago? *yes* *no*

3. If there is a recycling facility at your marina but you do not use it, please tell us why.

a) sorting consume too much space on-board
b) too time consuming
c) too costly
d) will have little impact
e) other _____

Vessel Sewage

1. How do you dispose of your vessel sewage?

a) dump/pump wastes overboard
b) take sewage wastes home
c) do not produce sewage aboard vessel
d) do not have a holding tank
e) use marine pump-out station
f) other _____

2. Were you using this same practice two seasons ago? *yes* *no*

3. If there is a pump-out station in your area but you don't use it, please tell us why.

a) will have little impact
b) too time consuming
c) too costly
d) do not have a holding tank
e) unfamiliar with operation
f) other _____

BACKGROUND INFORMATION

Although we are requesting the following information, please note that we ask for nothing which could connect this questionnaire with you. Your name is not required and therefore your answers are confidential.

1. Sex: a) male b) female

2. Age: a) 17 & under b) 18-29 c) 30-39 d) 40-49 e) 50+

3. Occupation: a) professional b) technical skill c) sales d) administrative e) retired

4. What is your total household income?

a) under $25K b) $25K-$50K c) $51K-$65K d) $66K-$85K e) $86K-$105K f) $106K+

5. Type of Vessel: a) *sail* b) *power* c) *motorsailer*

6. Length of Vessel: a) under 15 feet b) 15-25 c) 26-35 d) 36-45 e) over 45 feet

7. Approximately how many boating trips do you make each year?

a) 0-5 b) 6-10 c) 11-15 d) 16-20 e) over 20 trips

8. How many years have you been boating? a) 0-2 b) 3-5 c) 6-9 d) 10-15 e) 15+

Appendix B

Sample Implementation Plan

The following is the BMP implementation plan developed for the installation of dustless vacuum sanders. The remaining implementation plans can either be obtained from CRC or the NBEP.

Vacuum Sander Implementation Plan

Summary Description

This technology targets sandings and paint chips produced through hull maintenance activities by capturing or containing them before they can reach the open environment. As opposed to traditional sanding equipment, this machine's sanding surface is ventilated to allow the attachment of a vacuum device which automatically collects the debris as it is removed.

Materials Inventory

The equipment to be purchased is the Fein Dust Free Basic Sanding System. This high quality system includes: Msf 636-1 Random Orbit Sander; Low Profile Dust Extractor with Auto Start; 16' Hose and Fittings; and a 5 pack of 1 micron filter bags. The equipment comes with a full one year warranty and a support plan which allows the owner to return the equipment every six months to the factory where it will be cleaned and overhauled at no charge (parts or labor). Cost: $1,357.45. Distributor: Tim Walter, Martin Walter Co., Inc. 1-800 356-6926.

In addition, a log book (as described below) will be developed to assist in the equipment rental and evaluation. Produced in house by the secretarial staff the cost for this manual is expected to be around $50.00 (time and materials).

Implementation Process

Once acquired, the equipment will then be publicized by mailing customers two publicity flyers and through the posting of these same flyers within the marina itself. The first mailing will occur in March, the second in April, and the postings will be within the marina's office and restrooms and at the top of each main pier. Managed by the marina on a first come first serve basis reservations will be possible but tenants will be required to pay a nominal rental fee ($3.00/day) to use the equipment. The fee will be put into a fund used for the purchase of filter bags and general equipment maintenance as needed. Tenants will need to supply their own sanding disks. Before using the equipment all renters will be instructed on the operation and care of the machine. No permitting needs are associated with this implementation.

Evaluation Process

The effectiveness of this equipment at preventing such debris from entering the open environment will be evaluated by determining the number of times the equipment is used, the length of the bottom sanded, and the volume of debris collected by the machine. This

data will be collected through the use of a log book which details this use data and by keeping a running total of volumes collected. Several questions will also be included in the year end boater survey to be conducted by the marina. These questions will try to get a handle of the effectiveness of the publicity methods used and any reasons that the boaters may have for not using the equipment.

Implementation Schedule

Purchasing procedures will be initiated in February. Publicity will begin in March and monitoring and evaluation will carry through September 7 at which time the evaluation of practice will be completed and any identified program modifications will enter the planning stage.

Appendix C

Vacuum Sander Materials

The following materials contain the instructions given to marina operators and boaters upon their use of the vacuum sander, a sample log book sheet and a flyer used to publicize its availability.

Instructions for Marina Operators

If renters want to reserve a set time, there is a calendar included at the back of this manual in which you may schedule reservations.

When Renting the Equipment

- Check to see if the filter bag needs changing.
- Check to make sure that the equipment is working properly.
- Have them fill out the rental agreement.
- Demonstrate the equipment.
- Hand them an instruction sheet and then review it with them.
  (Instruction sheets are included at the back of this document)
- Emphasize that they are not to open the canister, or to empty or change the filter bags.
- Set them up with the proper sanding discs.
- When the renter returns the equipment, check to make sure that the equipment has not been damaged.

General

- The project's funders have required a rental fee of not more than $2:00 per hour for the first season. These funds are to be used for purchasing new filter bags and for shipping fees.

- It is very important that renters be instructed not to empty the filter bag.

- When it becomes necessary for marina staff to change the bags, they must be bagged, dated, and stored so that CRC/Sea Grant can evaluate the collected material.

- Along these lines it is also important that we keep detailed records about who rented the unit, and more importantly what the job performed was and length of the boat.

INSTRUCTIONS FOR VACUUM SANDER USE

PLEASE READ AND UNDERSTAND THESE INSTRUCTIONS IN ORDER TO SAFELY USE THE FEIN DUSTLESS SANDER

The equipment you are about to use has been provided to this marina as part of a nonpoint source pollution prevention for marinas within Greenwich Bay. The project is being conducted by the University of Rhode Island Coastal Resources Center/RI Sea Grant, M.A.S. with funding provided by the Rhode Island Department of Environmental Management, Narragansett Bay Project, through a grant issued by the USEPA under the Clean Water Act.

If you have any questions, now is the time to ask so as not to waste any time during your sanding operation. Following the instructions will provide you with the information you need to sand your hull efficiently for a fresh coat of bottom paint.

You will need to purchase and attach the proper sanding disc. (80 grit in most cases) by placing the disc on the pad so that the vacuum holes are all aligned. Plug into a socket. To activate the sander and vacuum, slide the switch on the sander forward, both will start. Slide the switch back to shut off the sander, the vacuum will shut down a moment later.

The following list of Do's and Don'ts Must be adhered to! NO EXCEPTIONS!
You are liable for any repair or replacement required on this expensive tool!
You are also responsible for your own safely.

DO

- Use common sense.
- Quit when you get tired.
- Keep a proper footing at all times.
- Make sure scaffolding, ladders, etc. are secure.
- Keep sander flat against the surface being sanded.
- Keep sander away from sharp curves, such as where keel meets the keel boss.

DON'T

- Drop sander.
- Drag vacuum across the gravel.
- Open canister, see marina management if you feel that the bag needs to be replaced.
- Remove liquids with the vacuum it is not your standard shop vac.
- Allow children to use sander.
- Overextend yourself.
- Allow sander to get wet! If it starts to rain- stop and unplug.
- Touch sanding pad or disc while sander is on.
- Use sander as an edge grinder.
- Hesitate to call a yard employee if tool begins to heat up, blow dust etc.
- Leave tool unattended

A few other tips to remember regarding personal health and safety. Although this is a *Dustless Sander*, respiratory protection is suggested- cover mouth and nose with a respirator or at least a dust mask. Eye protection is also recommended. Like most tools, this one makes considerable amount of noise; ear plugs or muffs can be the best bet to protect your hearing. You could wear gloves to reduce discomfort from vibration and keep hands clean but under no circumstances should you eat or smoke until you've washed your hands after sanding. Avoid wearing loose clothing and tie back long hair.

VACUUM SANDER RENTAL AGREEMENT

This vacuum sander is rented on the following conditions:

1. Unit may be reserved but rental is subject to availability.
2. Unit will be in working order at time of rental and accompanied by instructions
3. Rental charge will be used to purchase the necessary filters and for repairs.
4. Sanding discs will need to be purchased separately.
5. Unit must be used as indicated on instruction sheet.
6. Unit must be returned at agreed time.
7. Additional time available subject to availability.
8. Users will be held responsible for any damages to the unit.
9. Unit may not be left unattended or operated by person under the age of 18.
10. Unit may not be used outside of the marina premises.

Rental charge: $2.00 per hour

Name: _____

Address: _____

Boat Name: _____

Date Rented: _____

Time Checked Out: _____

Checked Out by: _____

Time Checked In: _____

Checked In By: _____

Fee Charged: _____

Task Performed (bottom sanding, finish work, etc.): _____

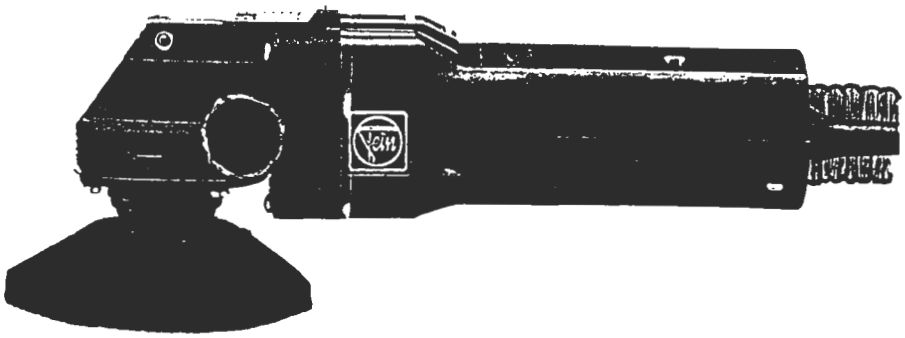
Boat Length: _____

Signature: _____

PLANNING ON SANDING YOUR BOTTOM THIS YEAR?

- Would you like to improve your efficiency while doing a better job?
- Are you aware of the health and environmental concerns associated with bottom paints?
- Do you lack the proper sanding equipment?

"WE HAVE THE SOLUTION"



- Wharf Marina now has a professional *Fein* dust-free vacuum sander available for your use.

This piece of equipment combines a powerful six inch random orbit sanding surface with an integrated low profile dust extractor to ease your most difficult sanding tasks while also protecting your health and the environment by automatically cleaning up behind you.

Contact the marina office to reserve the equipment for your use, but please plan ahead. We have only one machine and demand is bound to be high.

Appendix D

Recycling Publicity Flyer

The following publicity flyer for the recycling of glass, tin, and plastics was supplied by the commercial service provider who hauls the facilities waste.

Waste Management Inc.

401-463-6215 1-800-972-4545

Recycling

Check it Out

✔ **Recycling conserves valuable resources.**

Recycling **one** ton of paper saves **204** trees and **8190** gallons of oil per year.

Making paper from recycled materials results in **74%** less air pollution and **35%** less water pollution.

Recycling **one** ton of paper keeps almost **60** pounds of air pollution out of the atmosphere that would have been produced if the paper has been manufactured from virgin resources.

✔ **Recycling saves landfill space.**

Why bury cans, bottles and papers in the ground when we can recycle them and use the materials to make new products?

✔ **Recycling is mandatory in Massachusetts & Rhode Island.**

It is illegal to dispose of recyclable material at disposal sites.

✔ **Reduce/Reuse.**

Avoid products with excess packaging.
Eliminate unnecessary bags when shopping.
Reuse things whenever possible.

✔ **Buy Recycled Products!**

Close the recycle loop by buying recycled products whenever possible.

Waste Management Inc

Recycling Program

The following will outline your new recycling program with the use of Recycle Carts for NEWSPAPER, GLASS & METAL and PLASTICS.

NEWSPAPER includes all newspapers & inserts.

GLASS, METAL & PLASTIC CONTANERS ONLY includes all colored container glass & tin cans (also aluminum cans). No Pyrex, ceramics or mirrors, please. No plates, cups, crystal, light bulbs or broken glass. Plastic includes plastic soda bottles & milk bottles labeled 1 & 2 on the bottom. (Liquor & detergent bottles acceptable in Massachusetts only).

Helpful Hints:

Getting your recyclable items to the recycle cart:

When using **bags to take recyclables to the cart, place materials into the cart then put bag into trash container.**

RINSE containers with water, labels can remain. **THROW AWAY ALL CAPS & LIDS.**

Please Help and Do Your Part

If you have any questions call

401-463-6215
1-800-972-4545

Appendix E

Boater Fact Sheets

The following Boater Fact Sheets were written by the author and published by the Rhode Island Sea Grant Marine Advisory Service in cooperation with the Narragansett Bay Estuary Program.

Sea Grant Rhode Island

BOATER FACT SHEET

Rhode Island Sea Grant, University of Rhode Island Bay Campus, Narragansett, Rhode Island 02882-1197 (401) 874-6842

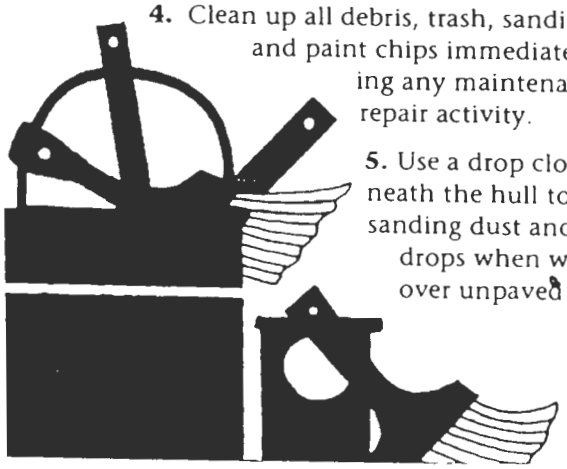
Sanding and Painting

Sanding and painting can be messy tasks. And if certain precautions are not taken, these tasks can also create a mess for the environment. Most of these paints are made with toxic chemicals designed to leach out and prevent bottom growth on the hull. When concentrated amounts of these materials are allowed to escape from hull maintenance and repair areas, there is a potential for environmental harm. Materials, such as solvents, thinners, and brush cleaners, often used in sanding and painting, can also harm the environment if improperly handled. These materials contain cancer-causing agents and have a tendency to sink in the water column, compromising water quality and damaging marine life and the marine environment.

You can play an important role in protecting water quality while sanding or painting your vessel by following the simple tips listed below.

Boater Tips:

1. When working in marinas, use designated sanding and painting areas. Check with the marina manager for the location and proper use of these areas.
2. Work indoors or under cover whenever wind can potentially blow dust and paint into the open air.
3. Use environmentally friendly tools, such as vacuum sanders and grinders, to collect and trap dust. Some marinas have this equipment for rent, check with the manager.
4. Clean up all debris, trash, sanding dust, and paint chips immediately following any maintenance or repair activity.
5. Use a drop cloth beneath the hull to catch sanding dust and paint drops when working over unpaved surfaces.



6. When sanding or grinding hulls over a paved surface, vacuuming or sweeping loose paint particles is the preferred cleanup method. Do not hose the debris away.
7. Buy paints, varnishes, solvents, and thinners in sizes that can be used within one year to avoid having to dispose of stale products.
8. When possible, use water-based paints and solvents.
9. Switch to longer lasting, harder, or non-toxic anti-fouling paint at your next haul out.
10. Paints, solvents, and reducers should be mixed far from the water's edge and transferred to work areas in tightly covered containers of 1 gallon or less.
11. Keep in mind that solvents and thinners can be used more than once by allowing the solids to settle out and draining the clean product off the top.
12. Let *small* quantities of unusable solvents evaporate by brushing them onto an old board.
13. Thoroughly dry all paint cans before disposing of them in the trash.
14. When in doubt about proper disposal practices, check with your marina or local municipality.

The boater fact sheet series is produced by the Rhode Island Sea Grant Marine Advisory Service with funding from the R.I. Department of Environmental Management Narragansett Bay Project, through a grant issued by the U.S. Environmental Protection Agency under the Clean Water Act.

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Sea Grant Rhode Island

BOATER FACT SHEET

Rhode Island Sea Grant, University of Rhode Island Bay Campus, Narragansett, Rhode Island 02882-1197 (401) 874-6842

Solid Waste Disposal

Each piece of trash and litter that enters Rhode Island's waters adds to a problem that can be easily recognized and prevented. Materials such as bottles, bags, cans, cups, six-pack rings, disposable diapers, cigarette butts, food stuffs, and fishing line not only degrade the natural beauty of boating waters, but they can also injure or kill aquatic life. Birds and fish often fatally mistake garbage for food and get tangled in plastic. Furthermore, many overheated engines and disabled sets of running gear can be attributed to improperly disposed of solid wastes.

Boater Tips:

1. Trash should never be discarded overboard. If there was room on board to bring it out, there is room to bring it back.
2. Carry a trash receptacle on board your vessel, and always empty it into a proper onshore facility. Most marinas have trash disposal and recycling areas—make use of them.
3. Try to reduce the amount of disposable litter on board by carrying less plastics, removing unnecessary wrappings and packaging, and using reusable containers for food and refreshments.
4. If trash accidentally falls overboard, go back and retrieve it.
5. When possible, retrieve any trash or debris found in the water or on the shore.
6. Never discard cigarette butts, diapers, or fishing line overboard.
7. Do not dispose of fats, solvents, oils, emulsifiers, disinfectants, paints, poisons, phosphates, and other similar products in Marine Sanitation Devices.
8. Whenever possible, use land-based rest rooms rather than onboard ones to reduce the amount of waste that must be pumped out.
9. Remember, law requires all boats 25 feet and more in length to have a sign regarding federal trash disposal regulations posted and visible where garbage is stored (these signs are available at most marine supply stores).
10. Inform and educate your family, friends, and neighbors on proper waste disposal practices.

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NARRAGANSETT BAY PROJECT

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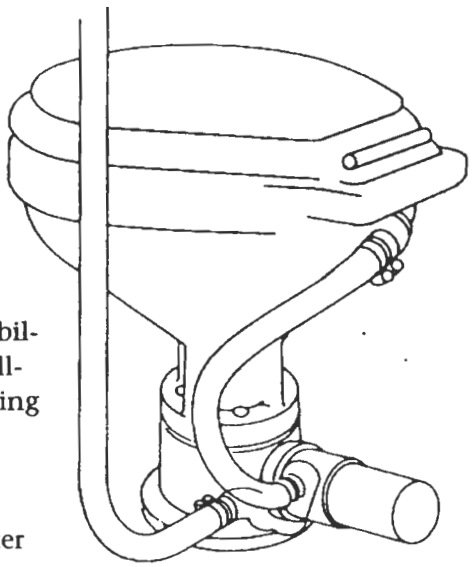
Sea Grant Rhode Island

BOATER FACT SHEET

Rhode Island Sea Grant, University of Rhode Island Bay Campus, Narragansett, Rhode Island 02882-1197 (401) 874-6842

Vessel Sewage



Vessel sewage is a problem when discharged into the water without proper pretreatment. Pathogens in untreated sewage increase the potential for human illness and the possibility of additional shellfish bed and swimming area closures. Added nutrients can also accelerate oxygen depletion in the water column by stimulating uncontrolled plant growth, called eutrophication, which can contribute to algal blooms, foul odors, and fish kills. This problem becomes more significant in enclosed harbors where boaters concentrate to anchor, swim, and fish.

You can play an important role in protecting water quality by following the simple tips listed below.

Boater Tips:

1. Always remember that it is illegal to discharge raw sewage from a vessel into U.S. waters.
2. In Rhode Island, it is illegal to operate or moor a boat that is equipped with a marine toilet that is not approved, not in proper working condition, or that is not properly sealed in declared no-discharge areas.
3. Pumpout facilities should be used to dispose of stored waste whenever possible. They are fast, clean, and inexpensive. New navigation charts and cruising guides now list the locations of operating pumpout stations.
4. Marine sanitation devices (MSDs) must be maintained to operate properly. Keep your disinfectant tank full, use biodegradable treatment chemicals, and follow the manufacturer's suggested maintenance program.
5. Do not dispose of fats, solvents, oils, emulsifiers, disinfectants, paints, poisons, phosphates, diapers, and other similar products in MSDs.
6. Whenever possible, use land-based rest rooms rather than onboard ones.

The boater fact sheet series is produced by the Rhode Island Sea Grant Marine Advisory Service with funding from the R.I. Department of Environmental Management Narragansett Bay Project, through a grant issued by the U.S. Environmental Protection Agency under the Clean Water Act.

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Sea Grant Rhode Island

BOATER FACT SHEET

Rhode Island Sea Grant, University of Rhode Island Bay Campus, Narragansett, Rhode Island 02882-1197 (401) 874-6842

Bilges, Fueling, and Spill Response

It is not uncommon to see a small fuel sheen on the water surface near boats. Although it may only be a tiny amount from some boats, the cumulative impacts can be damaging. Once in the marine environment, oils and fuels have a tendency to accumulate in bottom sediments and concentrate in marine organisms. These harmful substances commonly enter the marine environment through bilge pumping, fueling, and improper response to spills.

You can play an important role in protecting water quality by following the simple tips listed below.

Boater Tips:

1. Bilge Pumping

- Prior to pumping, inspect the bilge to ensure that no fuel or oil has been spilled.
- Do not discharge bilge water if there is a sheen to it.
- The best technique for dealing with oil in the bilge is to continually check and fix all leaks.
- Petroleum absorbent materials, such as bilge pillows and engine pan pads, are very effective at removing oils from bilge water.
- As a further preventative measure, oil/water separators can be installed in bilge pump discharge lines.
- If dirty bilge water cannot be sufficiently cleaned to allow legal discharge, make arrangements with a marina capable of properly disposing of tainted water.

2. Fueling

- Prevent fuel from falling into the water during fueling.
- Don't just top off the tanks, know the capacities of your fuel tanks *prior* to filling.
- Place an absorbent pad or container over the fuel fill or under the fuel vent to collect accidental overflow.
- Listen to the filler pipe to anticipate when the tank is full and to avoid back-splash.
- Stop pumping at the first sign of fuel escape.
- To prevent spillage from tank vents, install a fuel/air separator or an air whistle in your tank's vent line.

3. Spill Response

- Stop the source of the spill first.
- Then focus on containing it, preferably with booms.
- When a spill does occur, it should be reported immediately—federal law requires it.
- Do not use emulsifiers or dispersants (soaps) to treat a spill; this is prohibited by federal law.
- For small spill cleanup, cover the spill with absorbent materials.
- When clean up is complete, properly dispose of used spill response materials.

The boater fact sheet series is produced by the Rhode Island Sea Grant Marine Advisory Service with funding from the R.I. Department of Environmental Management Narragansett Bay Project, through a grant issued by the U.S. Environmental Protection Agency under the Clean Water Act.

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Sea Grant Rhode Island BOATER FACT SHEET

Rhode Island Sea Grant, University of Rhode Island Bay Campus, Narragansett, Rhode Island 02882-1197 (401) 874-6842

Vessel Cleaning and Fish Wastes

Many cleaning products are toxic, nonbiodegradable, and contain chemicals that can harm marine organisms. In addition, many cleaners are phosphate-based, and may therefore contribute to algal blooms, low dissolved oxygen levels, foul odors, and even fish kills.

As opposed to many cleaning products, fish wastes are absolutely biodegradable and can be eaten by other fish, birds, and marine animals. But when many fish are cleaned and the waste discarded into the same water area on the same day, such as at fishing tournaments, there can be a real disposal problem. Too much deteriorating fish waste in a small area of water is unsightly and can also result in extremely foul odors and decreased dissolved oxygen levels in the water column.

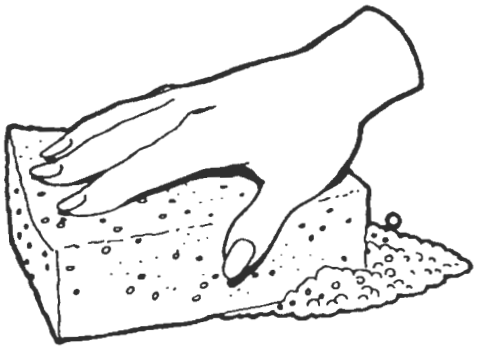
You can play an important role in protecting water quality while cleaning your vessel and/or disposing of fish wastes by following the simple tips listed below.

Boater Tips:

1. Vessel Cleaning

- Minimize the use of soaps and detergents by washing your vessel more frequently with plain water.
- Do not use cleaners that contain ammonia, sodium, chlorinated solvents, petroleum distillates, or lye.
- Buy and use only nontoxic, phosphate-free, biodegradable cleaners.
- Substitute chemical cleansers with natural ones, such as vinegar, citric juices, borax, and baking soda.
- Use hose nozzles that shut off when released to conserve water and reduce the runoff from boat washing.
- Do not clean the bottom of your vessel by scraping or scrubbing it while it is still in the water.

2. Fish Wastes



- Fish wastes should be disposed in unrestricted open waters.
- Clean fish as they are caught offshore or on the way back in.
- Do not dispose of fish wastes in marina basins.
- Many marinas have designated fish-cleaning stations with cutting tables, wash down basins, and covered trash containers or composting programs. Check with your marina.
- Reuse fish wastes as bait and/or chum on your next fishing trip.
- When no such options exist, bag fish waste and dispose of it in the trash.

The boater fact sheet series is produced by the Rhode Island Sea Grant Marine Advisory Service with funding from the R.I. Department of Environmental Management Narragansett Bay Project, through a grant issued by the U.S. Environmental Protection Agency under the Clean Water Act.

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BOATER FACT SHEET

Rhode Island Sea Grant, University of Rhode Island Bay Campus, Narragansett, Rhode Island 02882-1197 (401) 874-6842

Engine Maintenance

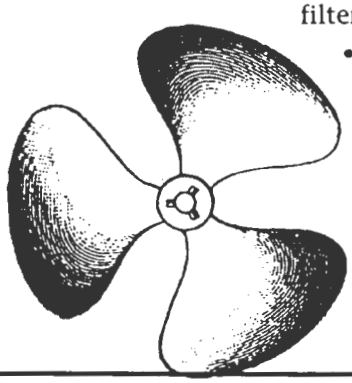
It is not infrequently that we see a small fuel sheen on the water surface near boats. Although it may be only a tiny amount from some boats, the cumulative impacts can be damaging. Once in the marine environment, oils and fuels have a tendency to accumulate in bottom sediments and concentrate in marine organisms. These harmful substances commonly enter the marine environment through improper engine maintenance techniques and waste fluids disposal practices.

You can play an important role in protecting water quality while performing routine engine maintenance by following the simple tips listed below.

Boater Tips:

1. Routine Engine Maintenance

- Keep engines properly tuned for efficient fuel consumption, clean exhaust, and economy.
- Keep your engine clean. It makes it easier to spot and correct small leaks before they become big problems.
- Keep an oil absorption pad in the bilge or below the engine to collect spilled products.
- When undertaking maintenance, wipe up spills so that they do not get pumped overboard with bilge water.
- For spill-proof oil changes, use non-spill pump systems that remove crankcase oils through the dipstick tube. Many marinas have these systems available for your use; check with them.
- In order to catch the oil traditionally spilled during filter removal, slip a plastic bag over the filter and then remove it.



- Keep the use of engine cleaners to a minimum. Parts cleaning should not be done in the bilge or over open ground. It should be done in a container or parts washer where the dirty fluids can be collected and recycled.
- Use the orange-pink colored propylene antifreeze, which is nontoxic, rather than the blue-green colored ethylene glycol, which is toxic and can kill animals that ingest it.
- Keep fuel tanks full during winter storage to reduce condensation buildup.
- Consider adding a fuel stabilizer so that you will not have problems disposing of stale fuel in the spring.
- Do not discharge oil into the water—it is prohibited by law. All boats 25 feet or longer are required to have a sign regarding oil pollution control regulations posted in the engine compartment. These signs are available at most marine supply stores.

2. Waste Disposal

- Never dump waste oils and engine coolants on the ground or into storm drains, dumpsters, and/or open waters.
- Most marinas and towns have specific disposal facilities for waste oils and associated byproducts, such as filters and absorptive materials. Ask about them, and use them.
- When disposing of petroleum-based products, such as fuels and engine oils, keep them separate from each other and from other substances, such as antifreezes, solvents, and water. This lowers the disposal cost charged to your collection facility for contaminated wastes.

The boater fact sheet series is produced by the Rhode Island Sea Grant Marine Advisory Service with funding from the R.I. Department of Environmental Management Narragansett Bay Project, through a grant issued by the U.S. Environmental Protection Agency under the Clean Water Act.

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Appendix F

Sample Sign Language

The following is the actual language used for the signs regarding Solid Waste Disposal Tips, Liquid Harmful Materials Collection, Pumpout Station Operation and Spill Response.

Solid Waste Disposal Tips

- Trash should *never be discarded overboard.* If there is room to bring it out, there is room to bring it back.
- *Sort wastes for standard recyclabes* and dispose of accordingly.
- *Always cleanup* after maintenance work.
- Bring harmful materials such as *solvents, used engine fluids, and filters* to the collection site at the rear of the facility.
- *Use pump-out facilities* to dispose of sanitary wastes.
- When in doubt, check with management.
- *Thank you* for helping to keep this Marina and the boating environment clean.

Harmful Materials Collection

No Smoking

- Keep incompatible liquids such as oil and antifreeze or gas and diesel separate.
- Be sure to match the material that you are disposing of with the appropriate receptacle.
- Oil filters should be left in the collection funnel to drain.
- Check with management for disposal of batteries
- *Thank you* for helping to keep this Marina and the boating environment clean.

Pumpout Operation

- Summer Hours: 8:00 AM - 6:00 PM;
- Fee: $5.00, tokens are available in the Ship's Store
- Instructions:

1. Insert token and verify that the machine is on.
2. Position the toggle switch on auto cycling mode.
3. Close valve in suction hose.
4. Insert the proper deck fitting into your boats waste outlet.
5. Connect the suction hose to the deck fitting using the hose's coupler.
6. Slowly open the valve on the hose
7. When the boat is empty, close the valve, remove the coupler and deck fitting.
8. When finished move the toggle switch to the off position.

Fuel Dock Hours
Responding to Spills

- Operating Hours: 6:00 AM - 7:00 PM.
- In the event of a fuel spill:

1. Identify the source of the spill
2. Attempt to stop it.
3. Notify the fuel station attendant.
4. Follow the plan contained in the response kit.

- No Smoking Allowed.

Appendix G

Workshop Materials

Session Plans and Publicity Flyer

The following materials contain: session plans that detail the conducting of the slide show format and walking tour boater workshop alternatives, plus an example publicity flyer which was used to publicize the events.

Boater Workshop Session Plan
Slide Show Presentation

Trainers: Manager _____, Staff Members _____,

Time Required: One hour and 15 minutes

Objective: To raise participant awareness of:

- The pollutants contributed to Greenwich Bay from recreational boating.
- The practices and products which boaters can use to reduce these contributions.

Location: _____

Needed Materials:

Equipment	Products	Educational Handouts
Slide Projector	Cleaners	Boater Fact Sheets
Screen	Head Chemicals	Pumpout Map
Spare Bulb	Antifreezes	Cleaning Article
Stand	Bottom Paints	Project Description
Extension Cord	Absorbents	GBI Progress Report
Display Tables	Fuel Conditioners	MARPOL Placard
Chairs	Fuel/Air Separator	Coastal Features

Contact CRC for Slides (italics denotes a photo, whereas everything else is text)

1. *Marina Photo*
2. *Marine Debris*
3. BMPs
4. *Recycling Can*
5. *Head*
6. BMPs
7. *Pumpout Sign*
8. *Gas Dock*
9. BMPs
10. *Fueling*
11. Spill Response BMPs
12. *Bilge pumping*
13. BMPs
14. *Bilge pillow*
15. *Engine*
16. BMPs
17. *Oil Change*
18. *Disposal facility*
19. BMPs
20. *Bottom Sanding*
21. BMPs
22. *Cst Grd Vessel*
23 *Vessel Cleaning*
24. BMPs

Content and Activity Plan:

6:00 PM **Welcoming**: 3 minutes

• Ex. - "In trying to better serve our customers and in being environmentally responsible, _____ Marina is proud to bring you this event

6:05 PM **Introduction:** 7 minutes

• Boating as a Source of Pollutants
• Brief Project Description, Including Sponsors
• Purpose and Format

6:10 PM **Vessel Operation:** 30 minutes

This discussion is based on four issues and facilitated by the use of a slide show and product examples. For each issue, a picture will be shown, a question posed, and then the problem discussed. Another question will then be posed which leads to a further discussion on the possible solutions to the problem. Once the solutions have been discussed, applicable product examples and additional slides will be shown.

Issues
• Marine Debris and Litter: Slides 2-4 with no product examples.
• Vessel Sewage: Slides 5-7 and head chemicals as product examples.
• Fueling: Slides 8-10 with fuel/air separators and conditioners as product examples.
• Spill Response: BMPs only, slide 11
• Bilge Pumping: Slides 12-14 with absorbents and bilge cleaners as product examples.

Rather than set aside pre-established times, participants will be encouraged to ask questions throughout the session. Once the material has been sufficiently covered an introduction will be provided for the next speaker.

6:40 PM **Vessel Repair and Maintenance** 30 minutes

This discussion is based on three issues and is also facilitated by the use of a slide show and product examples. As with vessel operation, for each issue a picture will be shown, a question posed, and then the problem discussed. Another question will then be posed which leads to a further discussion on the possible solutions to the problem. Once the solutions have been discussed, applicable product examples and additional slides will be shown.

Issues
• Engine Repair and Maintenance: Slides 15-17 with absorbents, and antifreezes as product examples.

- Waste Oil Disposal: Slides 18-19
- Sanding and Painting: Slides 20-22 with paints, solvents, and tarps as product examples.
- Vessel Cleaning: Slides 23-24 with environmentally compatible cleaners as product examples.

Rather than set aside pre-established times, participants will be encouraged to ask questions throughout the session.

7:10 PM **Conclusion:** 5 minutes

- The Incremental Pollution Concept.
- Everyone is Part of the Solution.
- Be a Good Example and Inform Your Friends .
- Thank You.

Boater Workshop Session Plan
Walking Tour Format

Trainers: Manager _____, Staff Members _____,

Time Required: Two hours.

Objective: To raise participant awareness of :

- the pollutant contributions associated with recreational boating; and
- the practices and products which boaters can use to reduce these contributions.

Location:_____

Preparation Schedule Used

9/28/95	First Mailing - Project Description.
10/10/95	Session Plan Review Meeting -
10/20/95	Second Mailing and Post Flyers.
10/24/95	Dry Run - (all trainers).
10/28/95	Workshop.

Needed Materials

Educational Handouts	Products	Equipment
Boater Fact Sheets	Cleaners	Sea Grant Banner
Pumpout Map	Head Chemicals	2 Portable Table
Cleaning Article	Antifreezes	Flip Charts
Project Description	Bottom Paints	2 Portable Easels
MARPOL Placard	Absorbents	
GBI Progress Report	Fuel Conditioner	
Coastal Features		

Content and Activity Plan:

Format - A facility tour approach will be used with the participants visiting a total of six stations. A different topic will be covered at each station. The facility manager will lead the participants between stations and will discuss, and if possible demonstrate, the relevant practices with the help of his staff. A flip chart of shortened boater tips will be posted at each station. These will serve as talking points for management and staff. In addition, relevant products will be displayed on a portable table at each station.

10:00 AM **Introduction:** 10 minutes, at office (Manager)
- Thank You for Coming
- Project Description
- Boating as a Source of Pollution
- Training Session Purpose/Format
- Introduce Next Speaker

10:10 AM **Engine Maintenance** 25 minutes, at mechanic shop (Manager and Staff)
Key Content: (Routine Maintenance Fact Sheet)
1. Potential Problem
2. Boater Tips (examples)
   - Keeping Engines Tuned and Clean - discuss
   - Spill Proof Oil Changes - discuss and show examples
   - Use of Absorbents/Bilge Pumping - discuss and show examples
   - Fueling - discuss
3. Winterization (examples)
   - How To - discuss
   - Toxic and Non-Toxic Antifreezes - discuss and show examples
   - Fuel Conditioning - discuss and show examples

10:35 AM **Liquid Waste Disposal:** 10 minutes, at disposal facility (Manager)
Key Content: (Routine Engine Maintenance Fact)
1. Potential Problem
2. Boater Tips (examples)
   - Keeping Products Separate - discuss
   - Waste Oils and Filter Disposal - demonstrate where and how

10:45 AM **Vessel Sewage:** 20 minutes, pumpout station (Manager and Staff)
Key Content: (disposal regulation and procedures - Vessel Sewage Fact Sheet)
1. Potential Problem
2. Boater Tips (examples)
   - Discharging Overboard - discuss legalities
   - Pumpout Procedure - demonstrate and discuss
   - Acceptable Treatment Chemicals - discuss and show examples

11:05 AM **Solid Waste Disposal:** 10 minutes, dumpster (Manager)
Key Content: (Marine Debris and Litter section, cleaning up after maintenance activities - Solid Waste Fact Sheet)
1. Potential Problem
2. Boater Tips (examples)
   - Vessel operation - discussion "what goes out must come back"
   - What Goes in Dumpsters and What Does Not - discuss
   - Batteries - discussion "where and how to dispose"

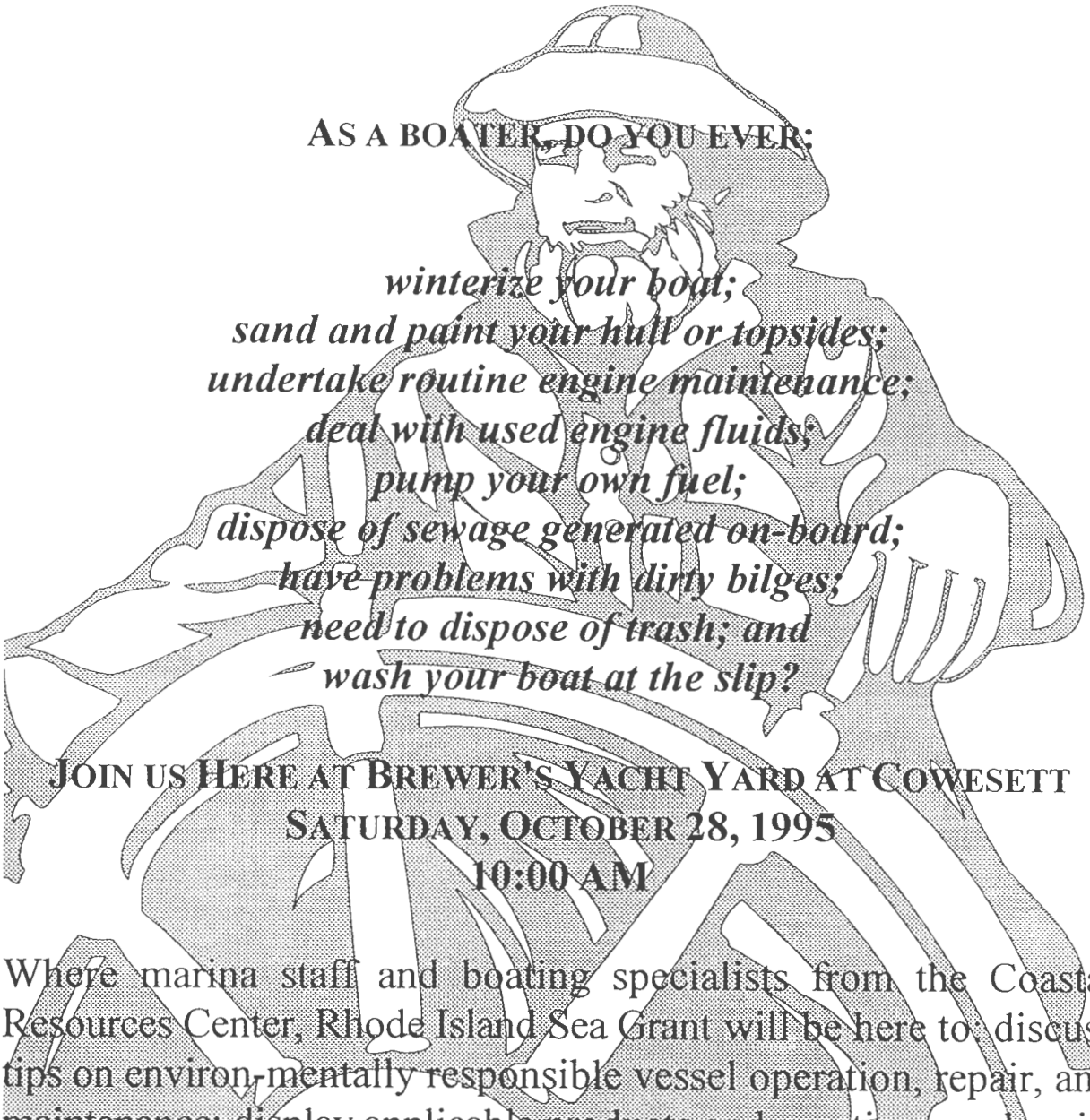
11:15 AM **Vessel Cleaning:** 10 minutes, at a boat being cleaned (Manager and Staff)
Key Content: (phosphate free and biodegradable cleaners/water conservation - Vessel Cleaning and Fish Waste Fact Sheet)
1. Potential Problem
2. Boater Tips (examples)
   - Choose the Right Products - discuss and show examples
   - Use Proper Techniques - discuss

11:25 AM **Sanding and Painting:** 25 minutes, at paint shop (Manager and Staff)
Key Content: (Product selection, cleanup and disposal - Sanding and Painting Fact Sheet)
1. Potential Problem
2. Boater Tips (examples)

   - Preparation /Cleanup - discuss and/or demonstrate
   - Selecting Paints and Solvents - discuss and show product examples
   - Handling Paints and Solvents - discuss
   - Disposing of Paints, Solvents, and Sandings - discussion

11:50 AM **Conclusion :** 10 minutes, at last station (Manager)
- The Incremental Pollution Concept
- Everyone is Part of the Solution
- Be a Good Example and Inform Your Friends
- When in Doubt Ask
- Thank You

LOOKING FOR VESSEL OPERATION, REPAIR, & MAINTENANCE TIPS?



AS A BOATER, DO YOU EVER:

winterize your boat;
sand and paint your hull or topsides;
undertake routine engine maintenance;
deal with used engine fluids;
pump your own fuel;
dispose of sewage generated on-board;
have problems with dirty bilges;
need to dispose of trash; and
wash your boat at the slip?

JOIN US HERE AT BREWER'S YACHT YARD AT COWESETT
SATURDAY, OCTOBER 28, 1995
10:00 AM

Where marina staff and boating specialists from the Coastal Resources Center, Rhode Island Sea Grant will be here to: discuss tips on environmentally responsible vessel operation, repair, and maintenance; display applicable products and practices; and assist you with any questions or concerns that you might have.

References and Additional Resources

References

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Dodson, P. 1994. *Practices and Products for Clean Marinas: A Best Management Practice Handbook.* International Marina Institute, Wickford, RI.

Dickerson, J. 1996. *Operation and Maintenance Plan for Controlling Nonpoint Source Pollution at Apponaug Harbor Marina.* As submitted to the Rhode Island Coastal Resources Management Council for approval under the State's Marina Operation and Maintenance Program.

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Ross, N. 1996. *Clean Marinas-Clear Value, Environmental and Business Success Stories.* US Environmental Protection Agency, Washington, DC EPA 841-R-96-003.

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Ruhling C. 1996. *Operation and Maintenance Plan for Controlling Nonpoint Source Pollution at Brewer's Yacht Yard at Cowesett*. As submitted to the Rhode Island Coastal Resources Management Council for approval under the State's Marina Operation and Maintenance Program.

United States Environmental Protection Agency. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. United States Government Printing Office, Washington, DC EPA 840-B-92-002.

Vassilopolous, P. 1996. *Operation and Maintenance Plan for Controlling Nonpoint Source Pollution at Wharf Marina*. As submitted to the Rhode Island Coastal Resources Management Council for approval under the State's Marina Operation and Maintenance Program.

Vildbig, G. 1996. *Operation and Maintenance Plan for Controlling Nonpoint Source Pollution at C-Lark Marina*. As submitted to the Rhode Island Coastal Resources Management Council for approval under the State's Marina Operation and Maintenance Program.

Additional Resources

Coastal Resources Center
URI Graduate Narragansett Bay Campus
South Ferry Road
Narragansett, RI 02881
(401) 874-6224
http://brooktrout.gso.uri.edu

International Marina Institute
35 Steamboat Ave.
Wickford, RI 02882
(401) 294-9558
http://www.imimarina.com

MarinaNet
http://seagrant.orst.edu/crt/index.html#marinanet

National Marine Manufactures Association
401N. Michigan Ave.
Chicago, Ill 60611
(312) 946-6200

Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879-1900

Rhode Island Marine Trades Association
PO Box 4468
Middletown, RI 02842
1-800 Boat-N-RI

Rhode Island Sea Grant M.A.S.
URI Graduate Narragansett Bay Campus
South Ferry Road
Narragansett, RI 02881
(401) 874-6842
http://brooktrout.gso.uri.ed:80/riseagrant/